US009191998B2

(12) **United States Patent**
Hegedis et al.

(10) **Patent No.: US 9,191,998 B2**
(45) **Date of Patent: Nov. 17, 2015**

(54) **MULTI COOKER**

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(73) Assignee: **Breville Pty Limited**, Alexandria, NSW (AU)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 208 days.

(21) Appl. No.: **13/810,200**

(22) PCT Filed: **Jul. 15, 2011**

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(2), (4) Date: **Jan. 14, 2013**

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PCT Pub. Date: **Jan. 19, 2012**

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US 2013/0112683 A1 May 9, 2013

(30) **Foreign Application Priority Data**
Jul. 15, 2010 (AU) 2010903149

(51) **Int. Cl.**

H05B 6/04	(2006.01)
H05B 6/12	(2006.01)
H05B 6/06	(2006.01)
A47J 27/62	(2006.01)
A47J 36/32	(2006.01)

(52) **U.S. Cl.**
CPC ***H05B 6/062*** (2013.01); ***A47J 27/62*** (2013.01); ***A47J 36/32*** (2013.01)

(58) **Field of Classification Search**
CPC A47J 27/62; A47J 36/32; H05B 6/062
USPC 219/620–627, 660, 663, 664, 667
See application file for complete search history.

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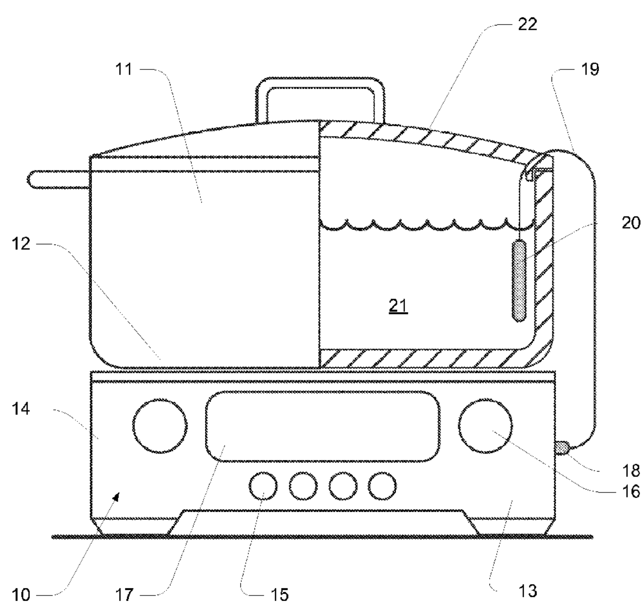
Primary Examiner — Dana Ross
Assistant Examiner — Lindsey C Teaters
(74) *Attorney, Agent, or Firm* — Molins & Co. Pty Ltd.

(57) **ABSTRACT**

A cooking appliance and method, the appliance including: at least one temperature controlled heating element; a user interface for enabling a user to select a predefined subject for cooking; and a processor module that maintains a cooking data for cooking the selected predefined subject, and provides prompts to the user during cooking. The cooking data can be indicative of a cooking sequence or procedure. A cookware sensor can automatically identifying cookware being used.

18 Claims, 37 Drawing Sheets



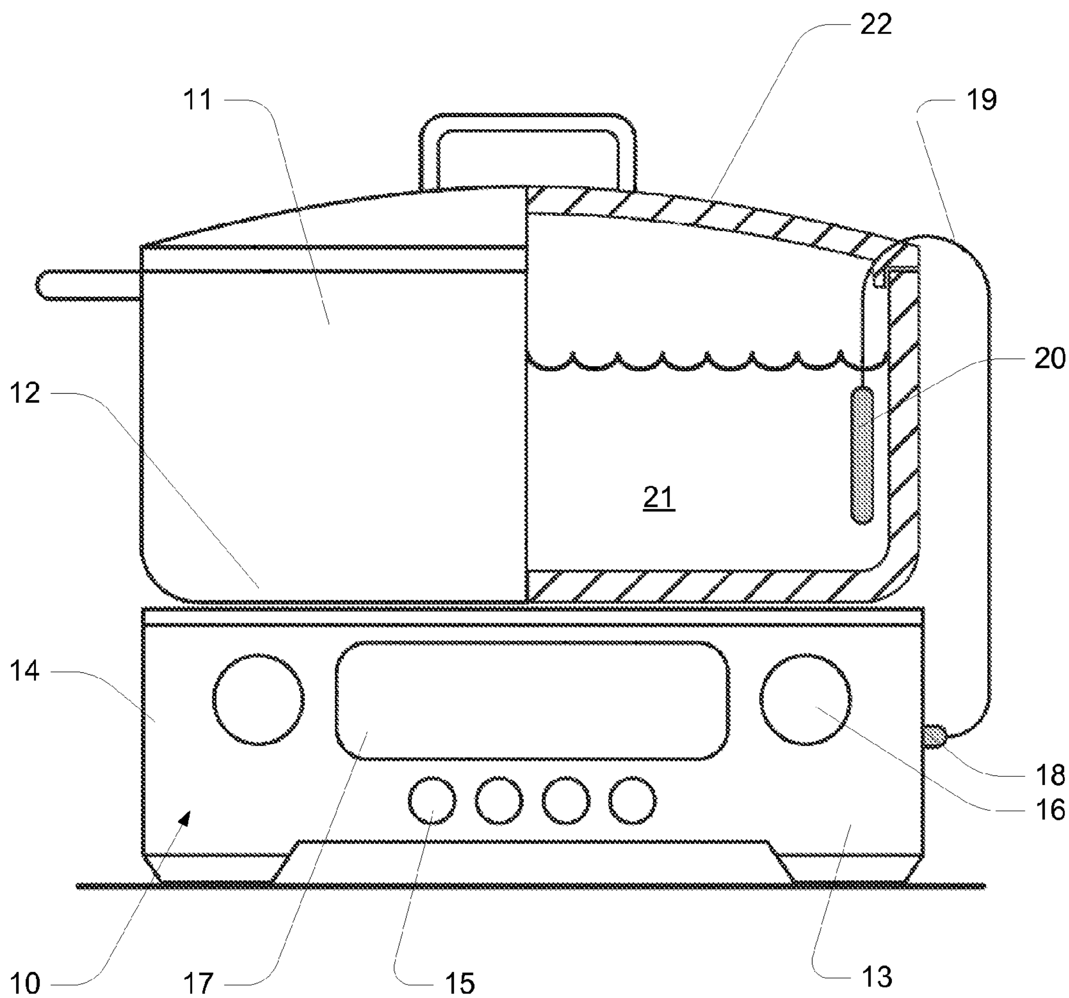


FIG. 1

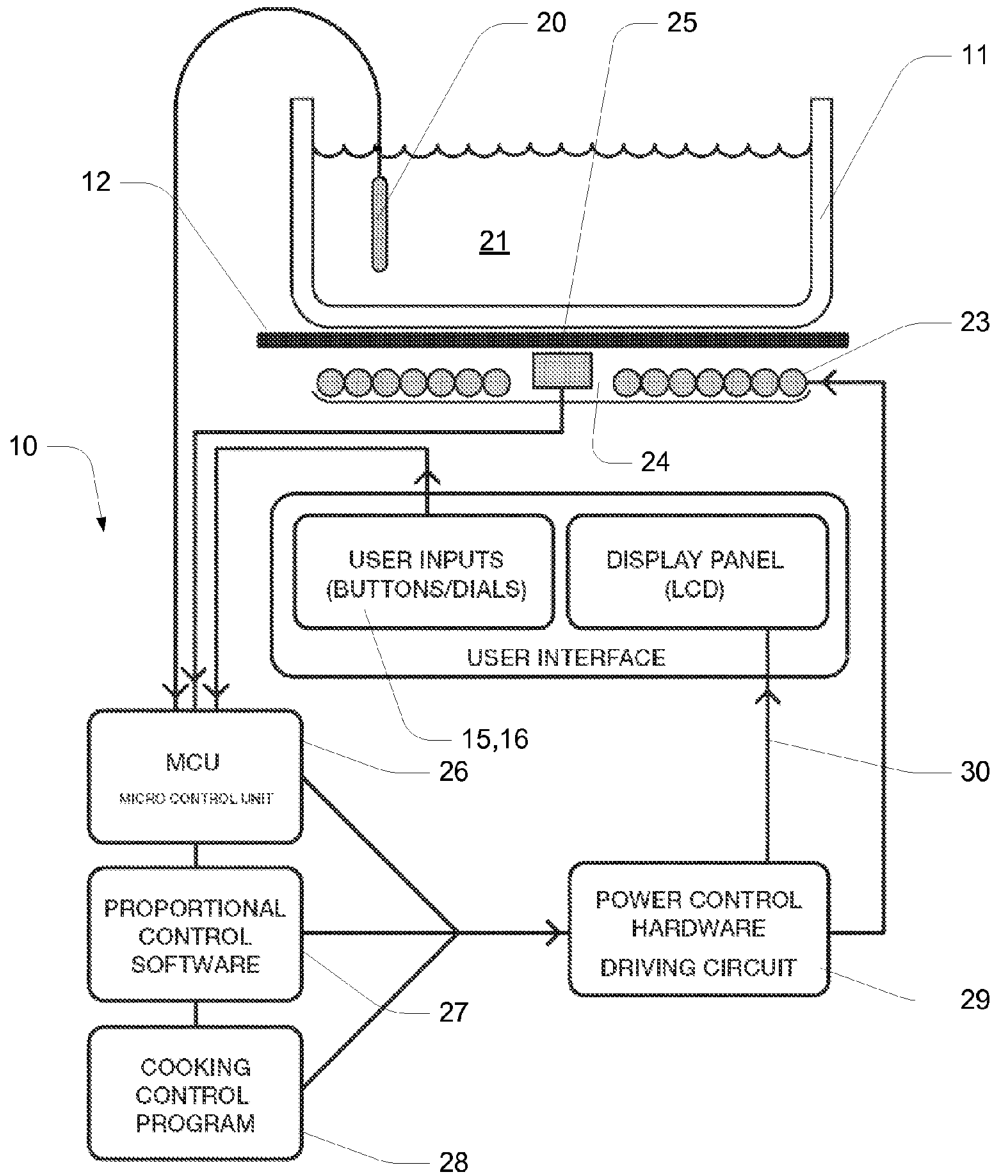

20
25
11
12
21
23
10
24
USER INPUTS
(BUTTONS/DIALS)
DISPLAY PANEL
(LCD)
USER INTERFACE
15,16
MCU
MICRO CONTROL UNIT
26
30
PROPORTIONAL
CONTROL
SOFTWARE
POWER CONTROL
HARDWARE
DRIVING CIRCUIT
29
27
COOKING
CONTROL
PROGRAM
28

FIG. 2A

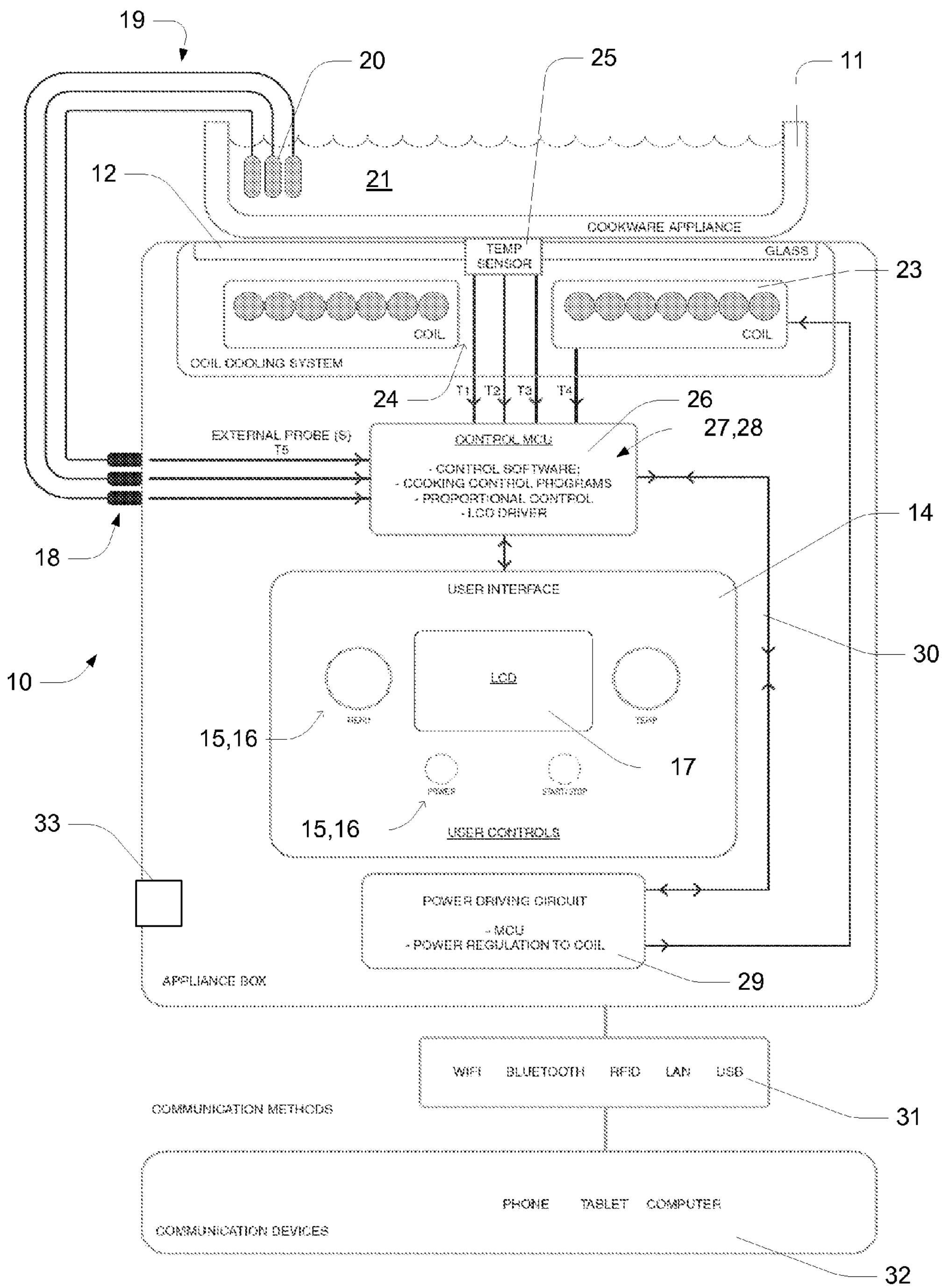

19
20
25
11
21
12
COOKWARE APPLIANCE
TEMP SENSOR
GLASS
23
COIL
COIL
COIL COOLING SYSTEM
24
T1
T2
T3
T4
26
27,28
EXTERNAL PROBE (S)
T5
CONTROL MCU
- CONTROL SOFTWARE:
- COOKING CONTROL PROGRAMS
- PROPORTIONAL CONTROL
- LCD DRIVER
18
14
USER INTERFACE
30
10
LCD
15,16
17
POWER
START/STOP
15,16
USER CONTROLS
33
POWER DRIVING CIRCUIT
- MCU
- POWER REGULATION TO COIL
APPLIANCE BOX
29
WIFI
BLUETOOTH
RFID
LAN
USB
COMMUNICATION METHODS
31
PHONE
TABLET
COMPUTER
COMMUNICATION DEVICES
32

FIG. 2B

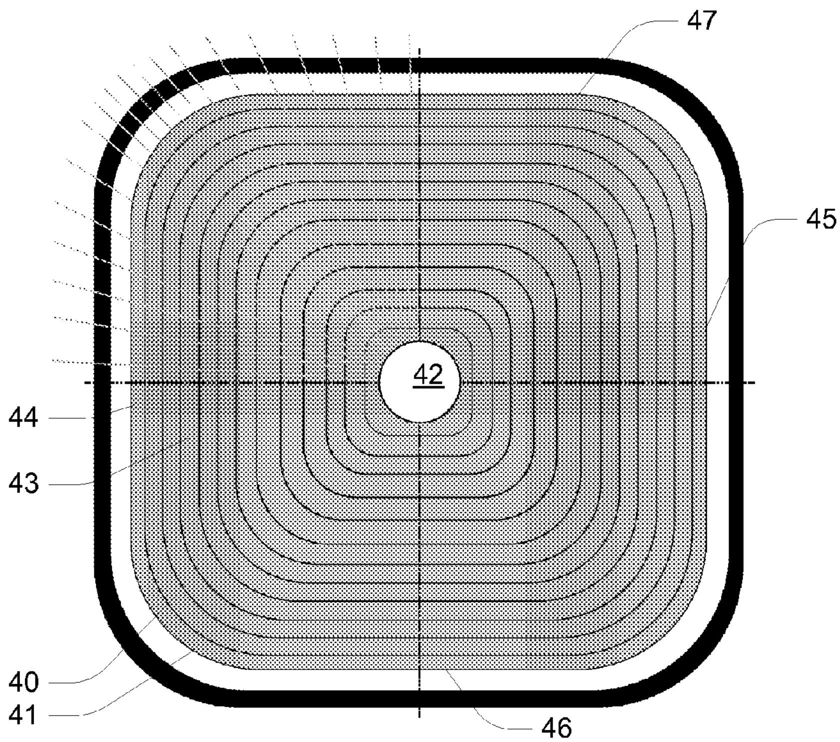


FIG. 3

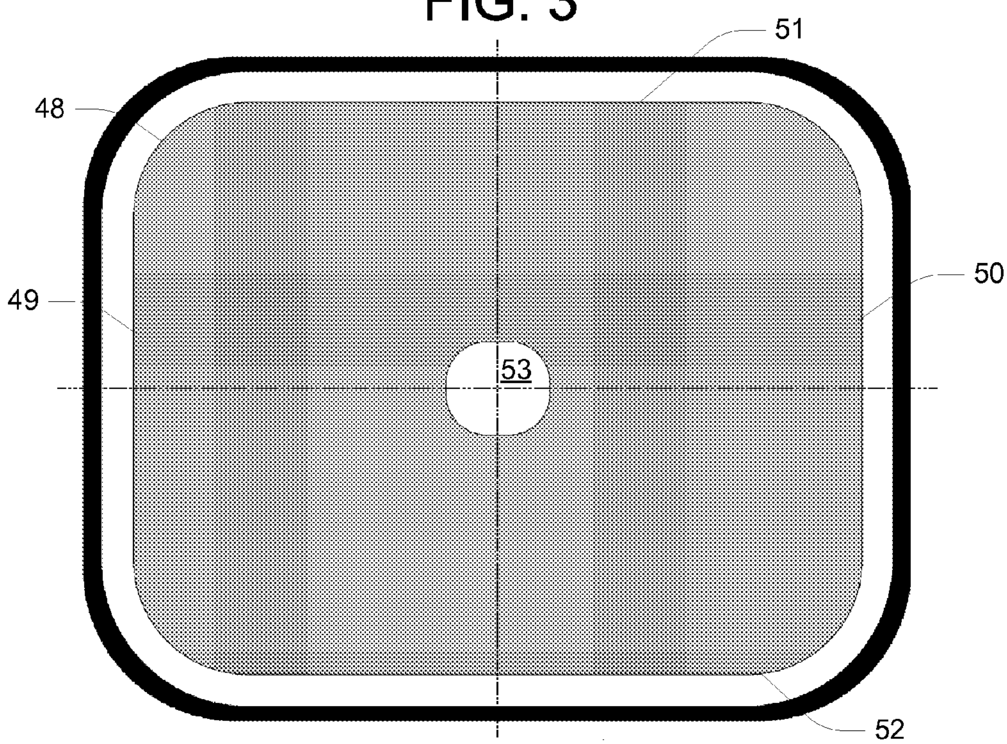


FIG. 4

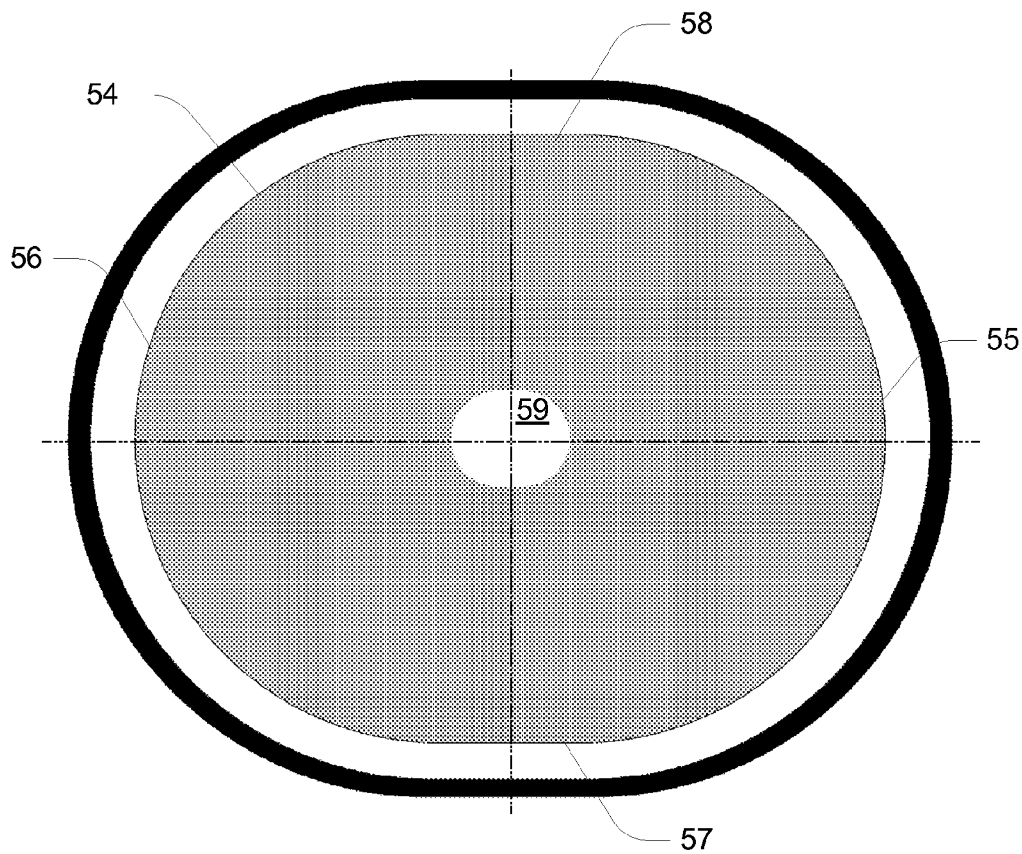


FIG. 5

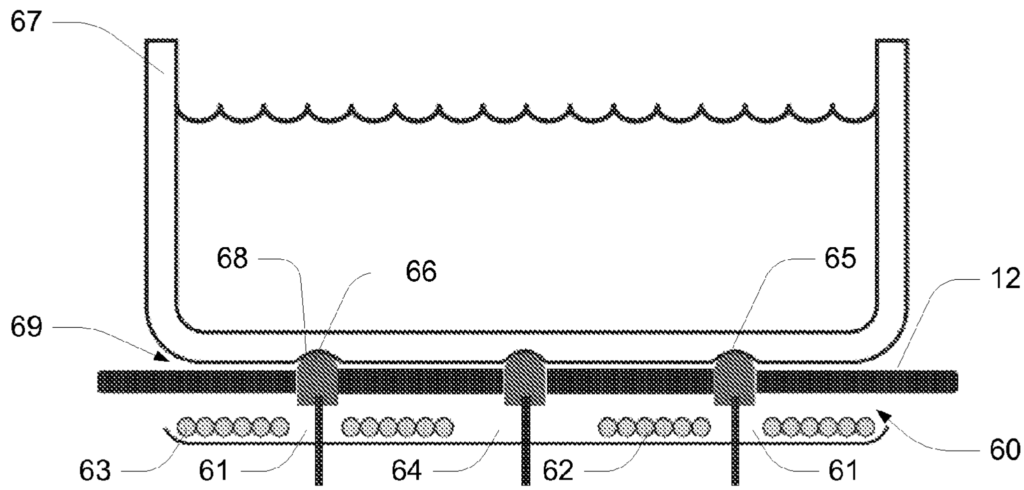


FIG. 6A

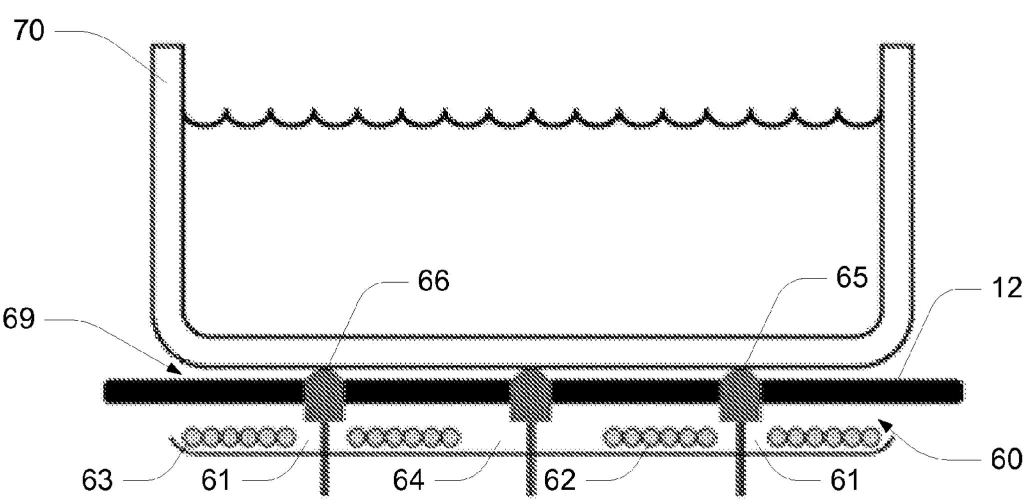


FIG. 6B

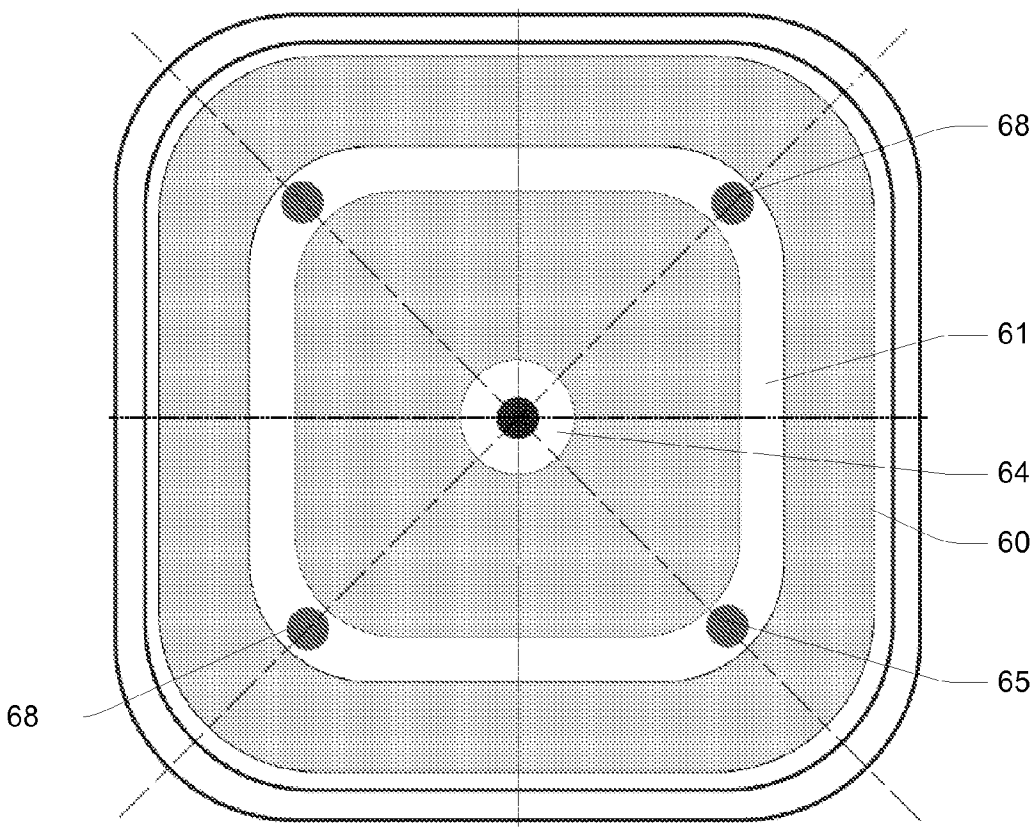


FIG. 7

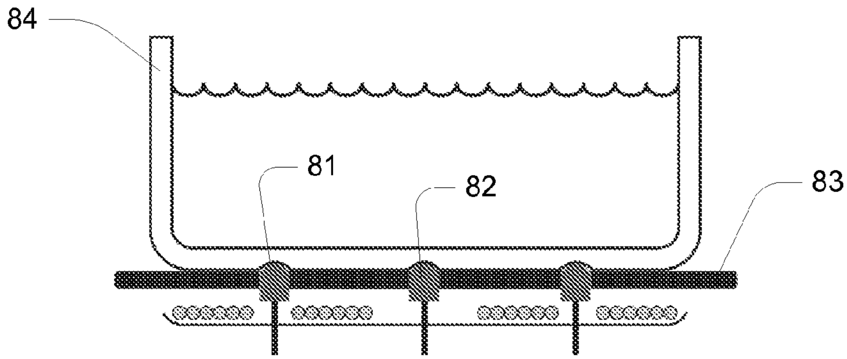


FIG. 8A

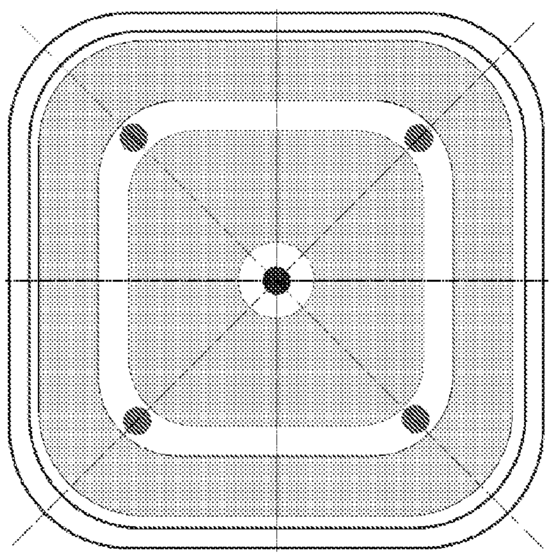


FIG. 8B

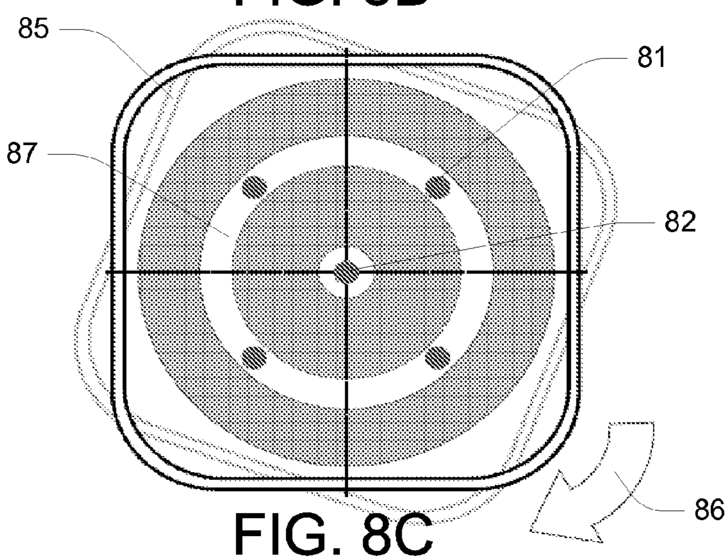


FIG. 8C

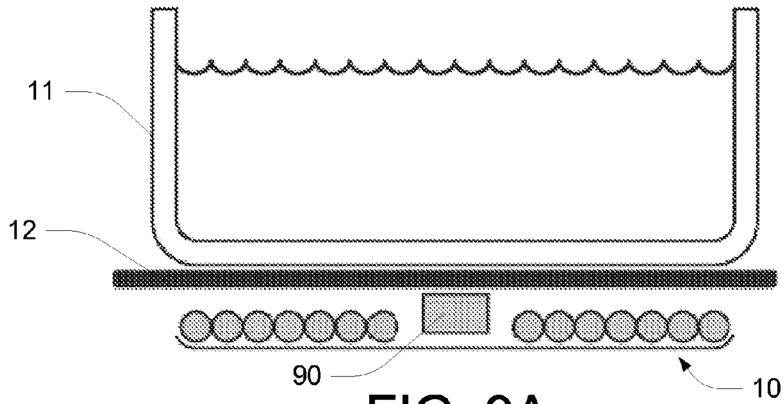


FIG. 9A

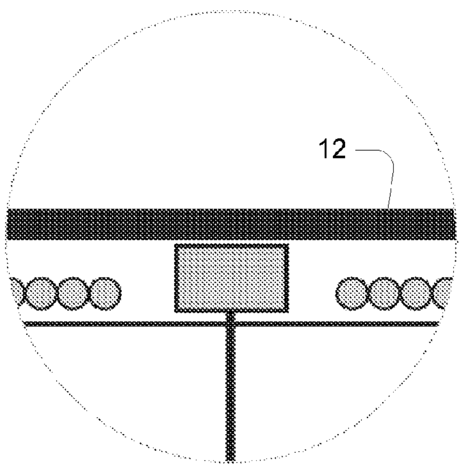


FIG. 9B

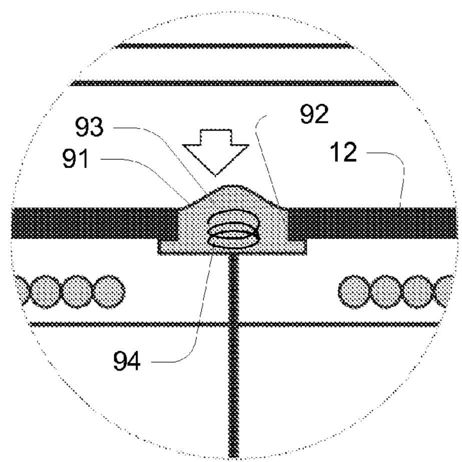


FIG. 9C

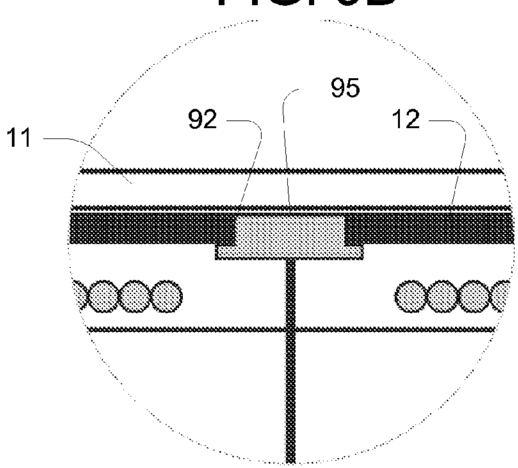


FIG. 9D

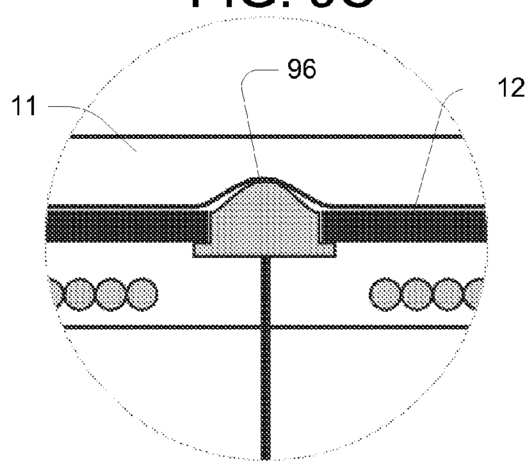


FIG. 9E

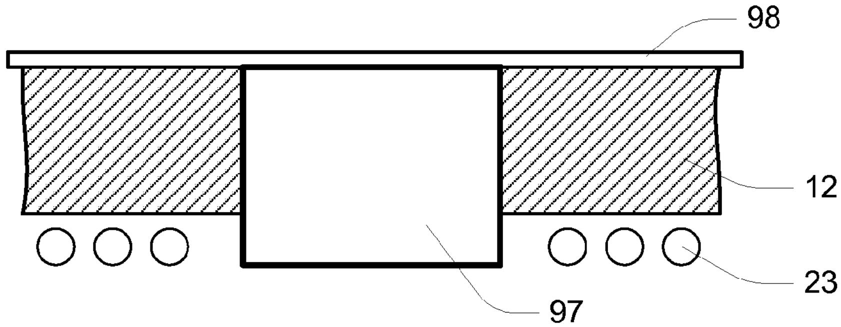


FIG. 9F

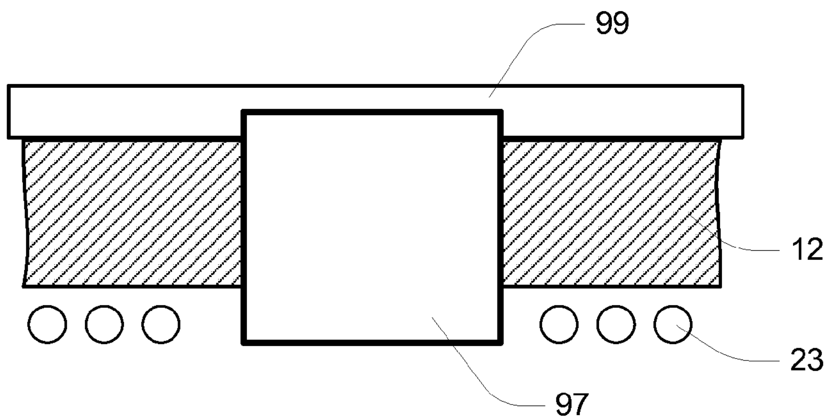


FIG. 9G

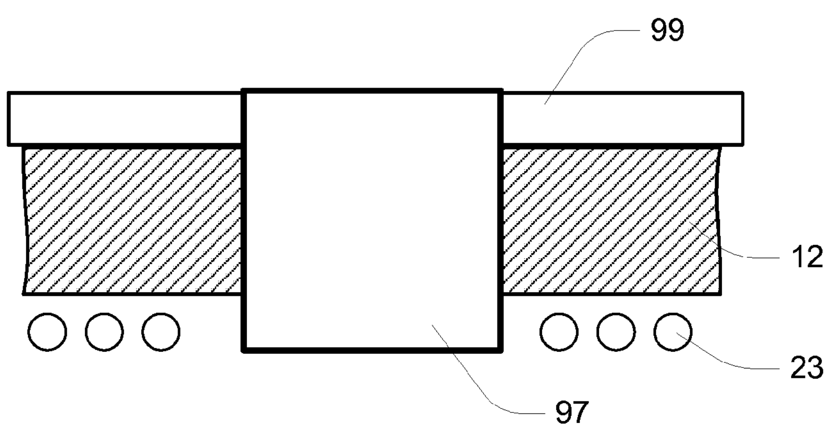


FIG. 9H

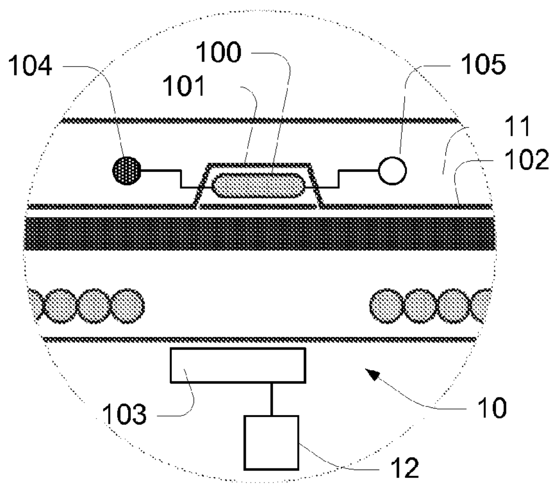


FIG. 10A

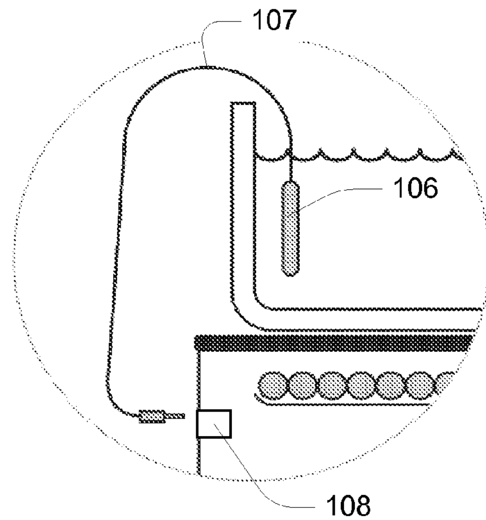


FIG. 10B

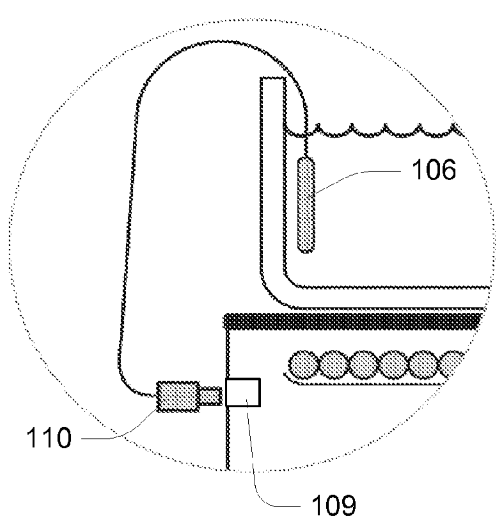


FIG. 10C

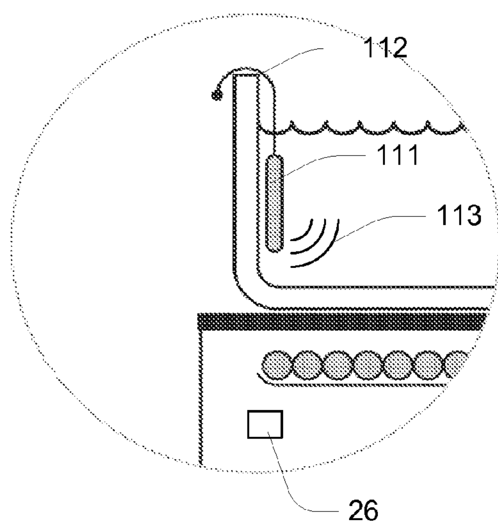


FIG. 10D

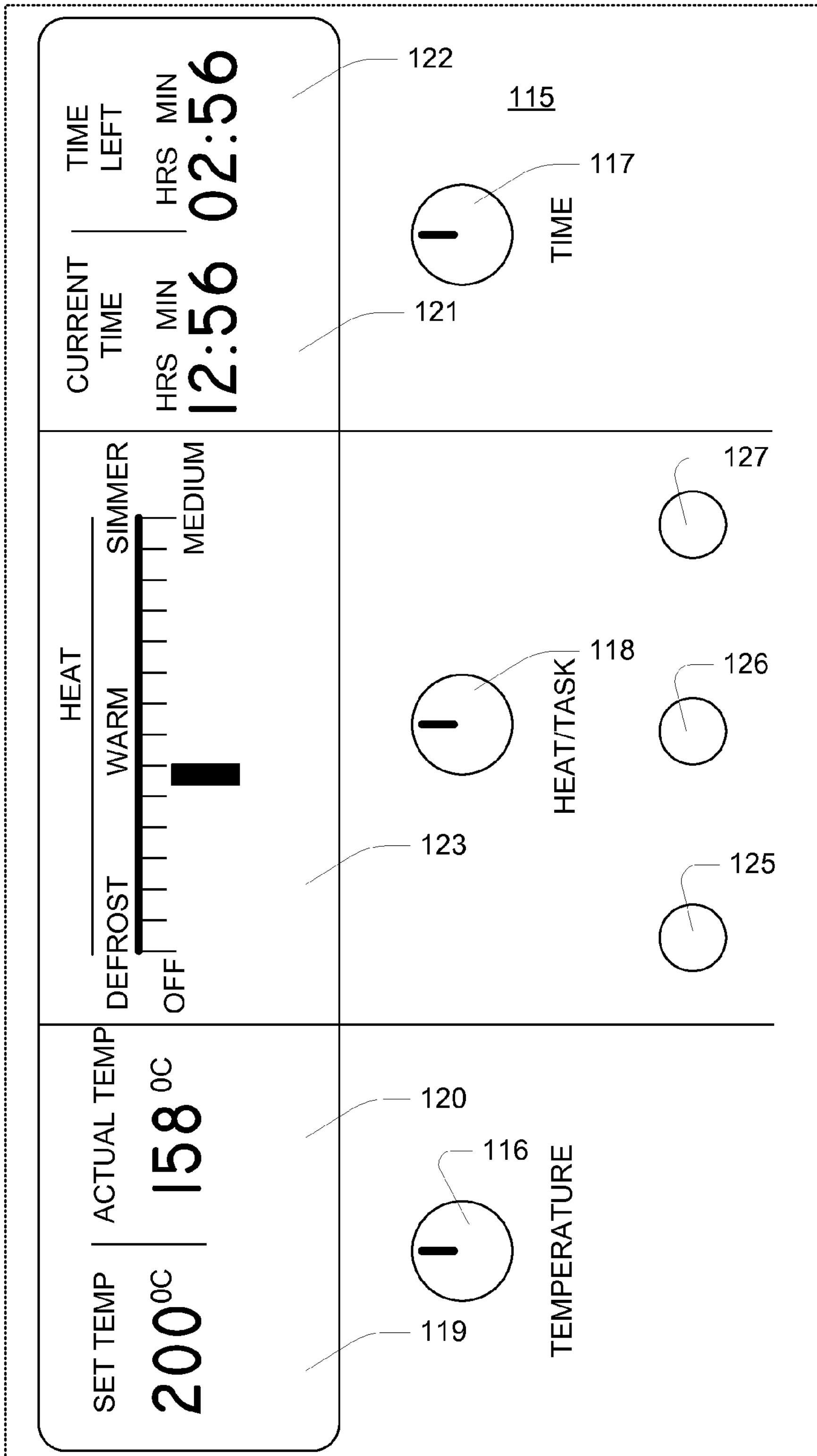

122
115
117
CURRENT TIME
HRS MIN
12:56
TIME LEFT
HRS MIN
02:56
121
TIME
HEAT
DEFROST
WARM
SIMMER
OFF
MEDIUM
127
118
126
HEAT/TASK
123
125
SET TEMP
200°C
ACTUAL TEMP
158 0C
120
116
119
TEMPERATURE

FIG. 11

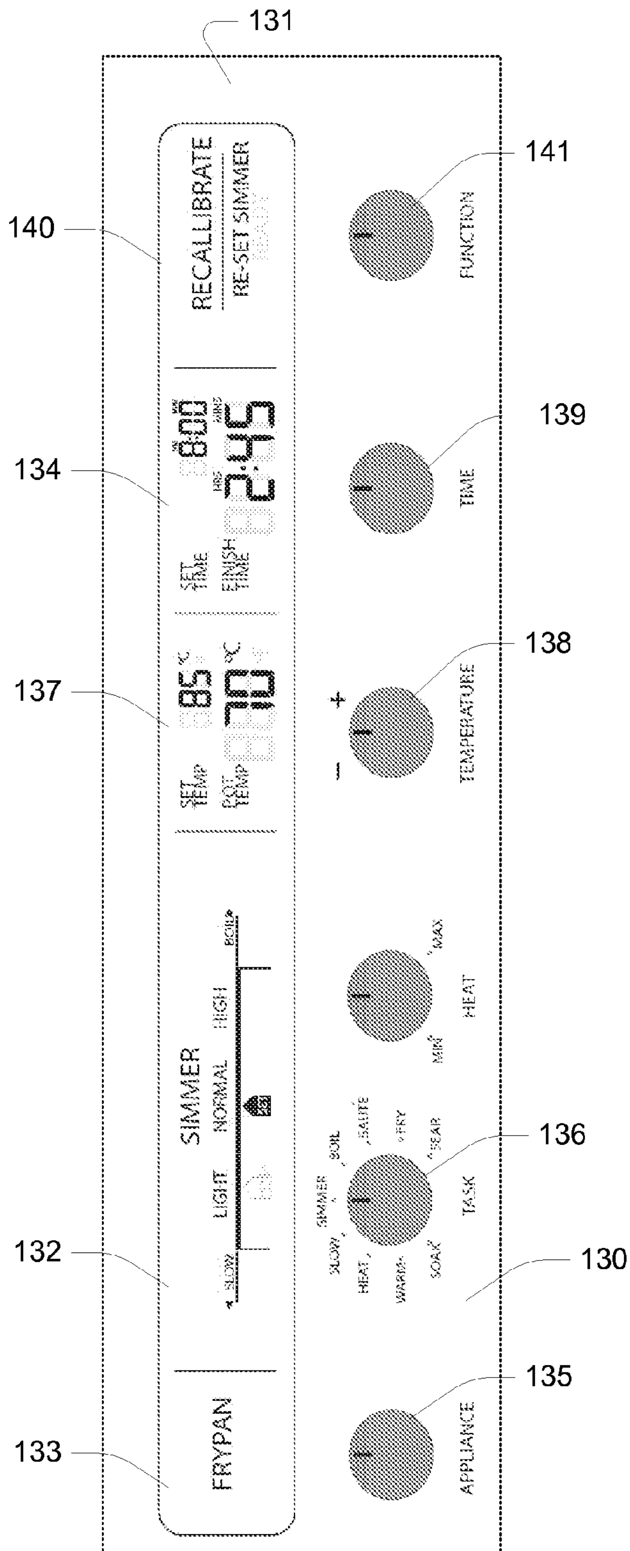

131
140
RECALLIBRATE
RE-SET SIMMER
141
FUNCTION
134
8:00
2:45
SET TIME
FINISH TIME
HRS
MINS
139
TIME
137
SET TEMP
POT TEMP
85
70
138
TEMPERATURE
+
–
SIMMER
LIGHT
NORMAL
HIGH
SLOW
BOIL
MIN
MAX
HEAT
136
SIMMER
BOIL
SAUTE
FRY
SEAR
SLOW
HEAT
WARM
SOAK
TASK
132
130
133
FRYPAN
135
APPLIANCE

FIG. 12

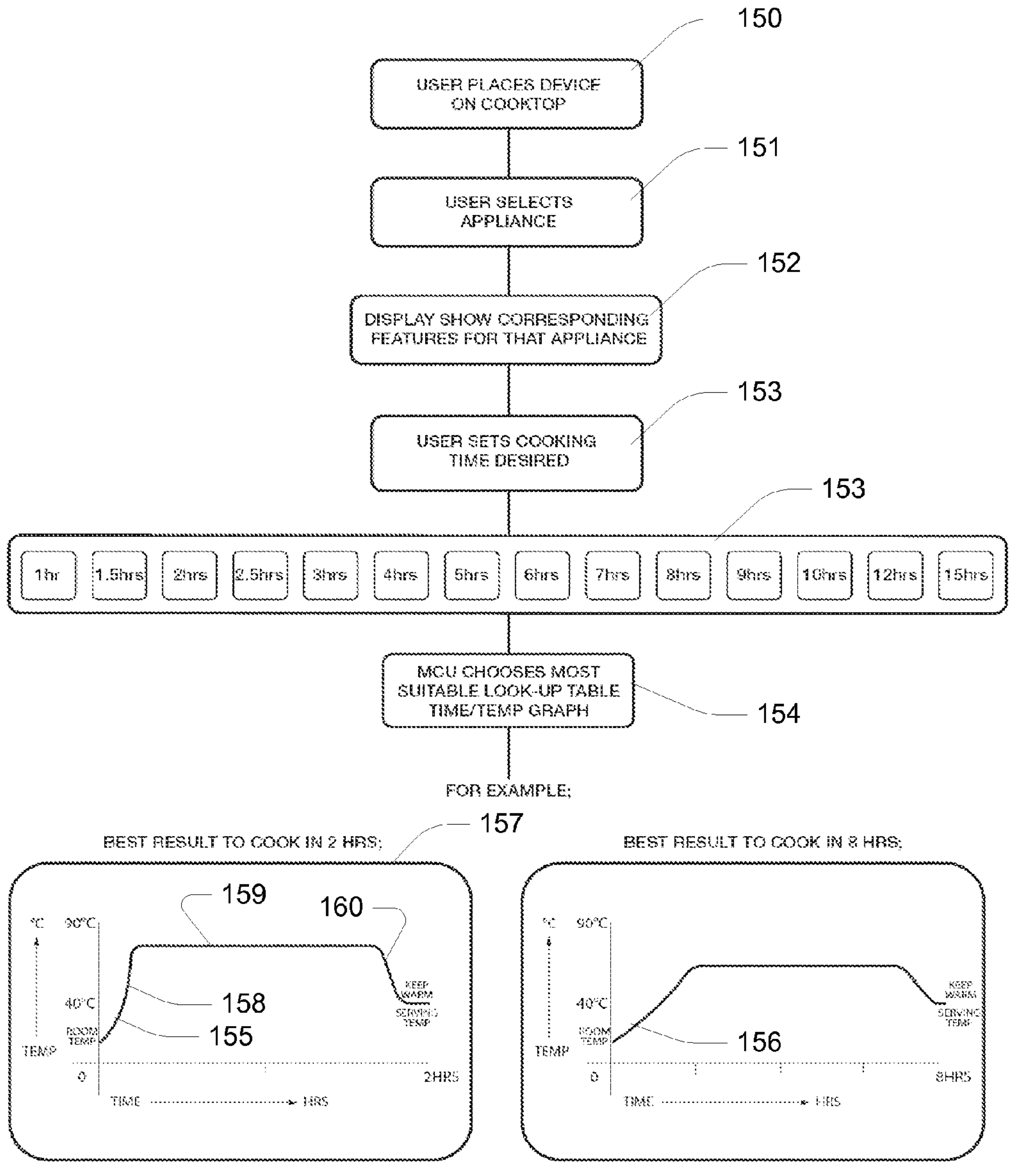

150
USER PLACES DEVICE ON COOKTOP
151
USER SELECTS APPLIANCE
152
DISPLAY SHOW CORRESPONDING FEATURES FOR THAT APPLIANCE
153
USER SETS COOKING TIME DESIRED
153
1hr
1.5hrs
2hrs
2.5hrs
3hrs
4hrs
5hrs
6hrs
7hrs
8hrs
9hrs
10hrs
12hrs
15hrs
MCU CHOOSES MOST SUITABLE LOOK-UP TABLE TIME/TEMP GRAPH
154
FOR EXAMPLE;
157
BEST RESULT TO COOK IN 2 HRS;
159
160
°C
90°C
40°C
ROOM TEMP
TEMP
158
155
KEEP WARM
SERVING TEMP
0
2HRS
TIME
HRS
BEST RESULT TO COOK IN 8 HRS;
°C
90°C
40°C
ROOM TEMP
TEMP
156
KEEP WARM
SERVING TEMP
0
8HRS
TIME
HRS

FIG. 13

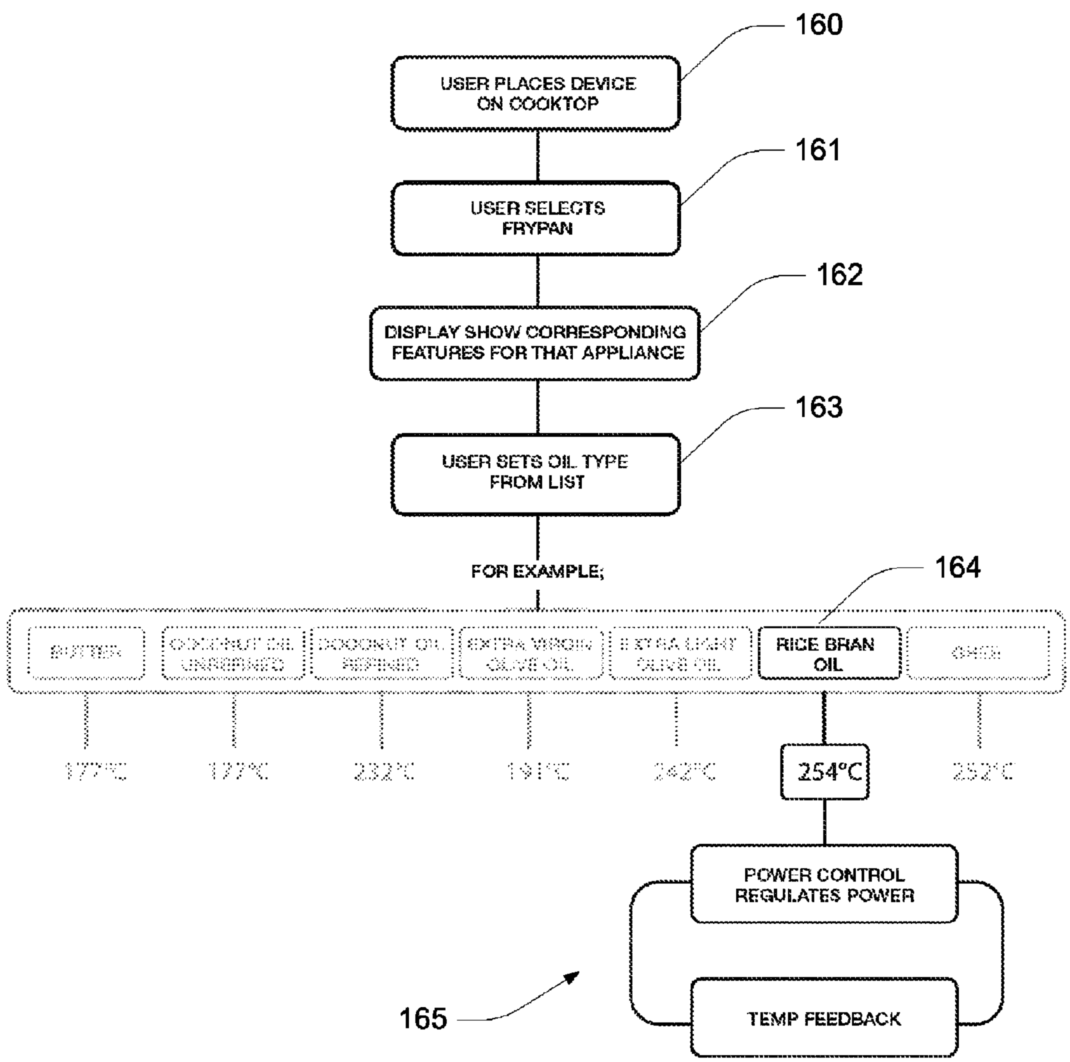

160
USER PLACES DEVICE ON COOKTOP
161
USER SELECTS FRYPAN
162
DISPLAY SHOW CORRESPONDING FEATURES FOR THAT APPLIANCE
163
USER SETS OIL TYPE FROM LIST
FOR EXAMPLE;
164
BUTTER
COCONUT OIL UNREFINED
COCONUT OIL REFINED
EXTRA VIRGIN OLIVE OIL
EXTRA LIGHT OLIVE OIL
RICE BRAN OIL
177°C
177°C
232°C
191°C
242°C
254°C
252°C
POWER CONTROL REGULATES POWER
TEMP FEEDBACK
165

FIG. 14

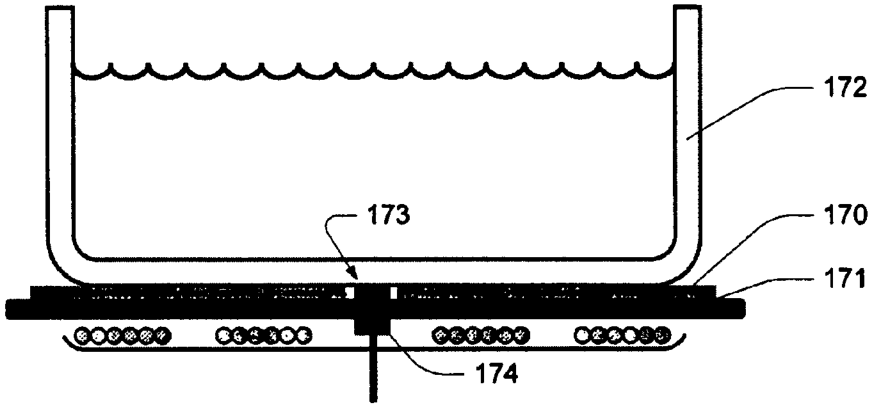


FIG. 15A

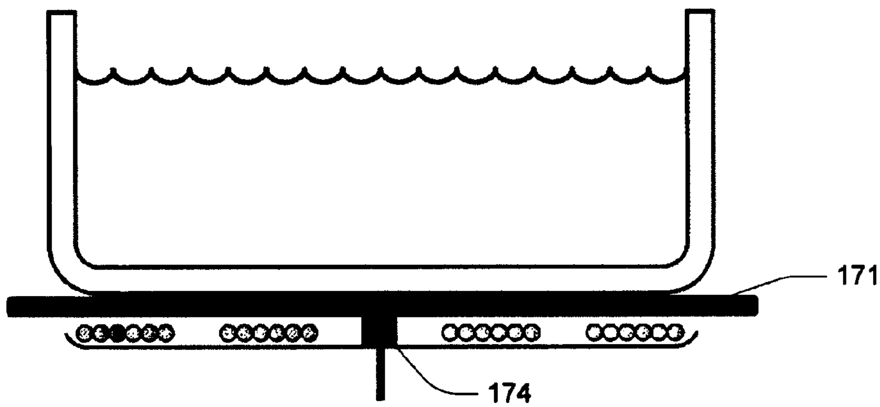


FIG. 15B

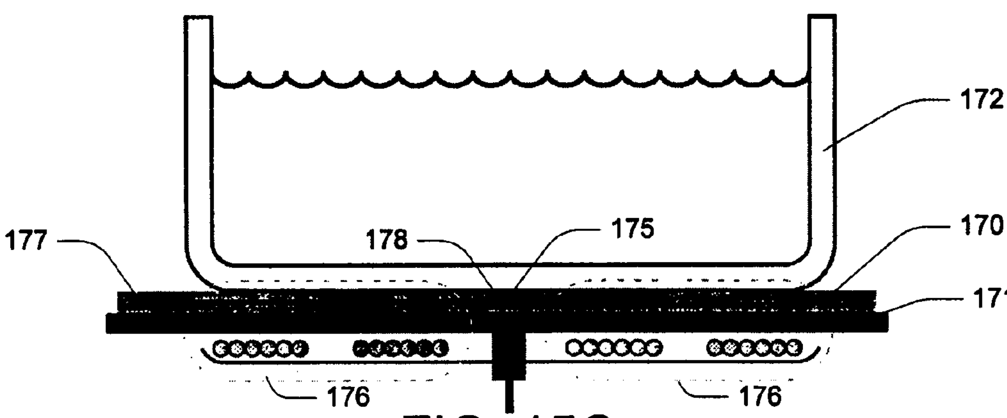


FIG. 15C

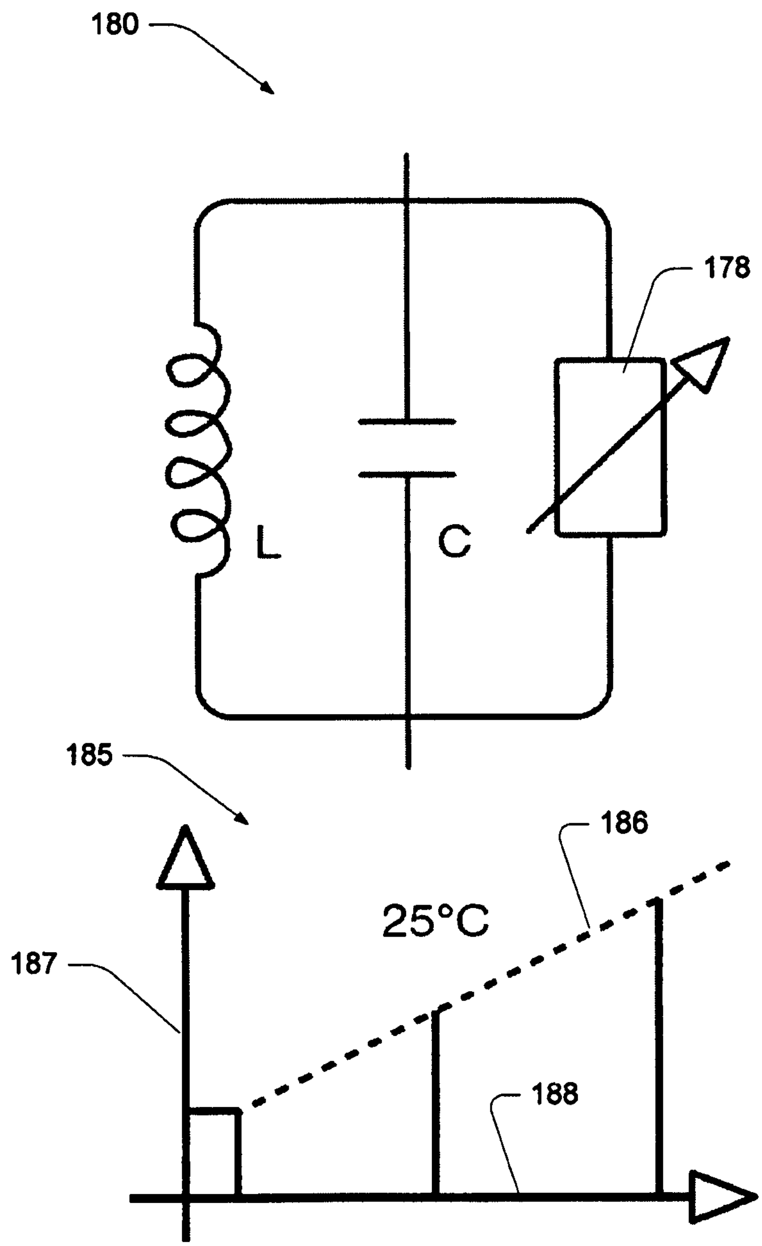


FIG. 16

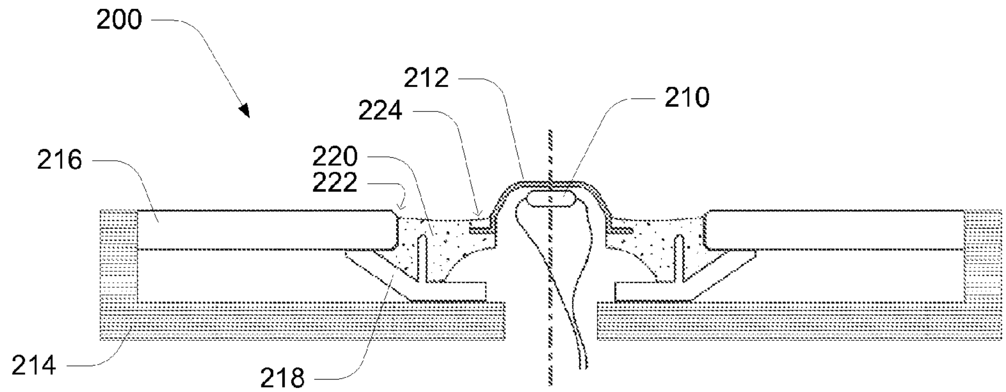


FIG. 17A

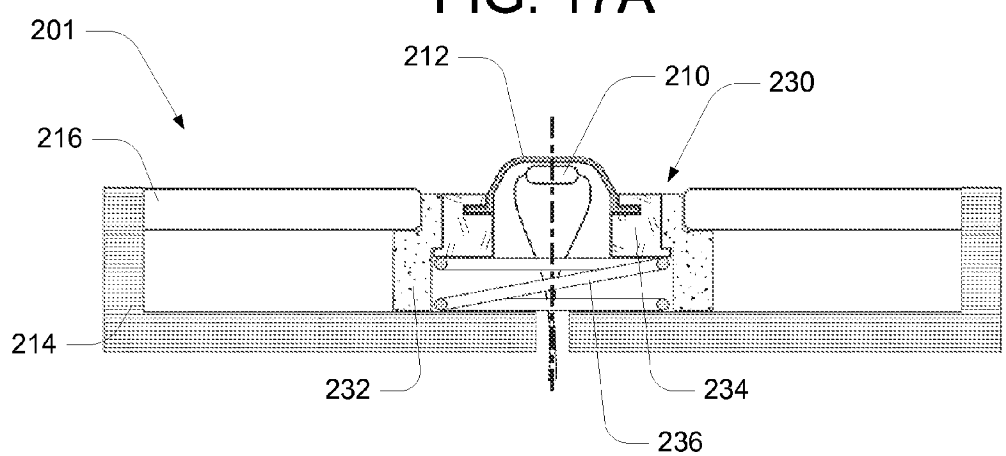


FIG. 17B

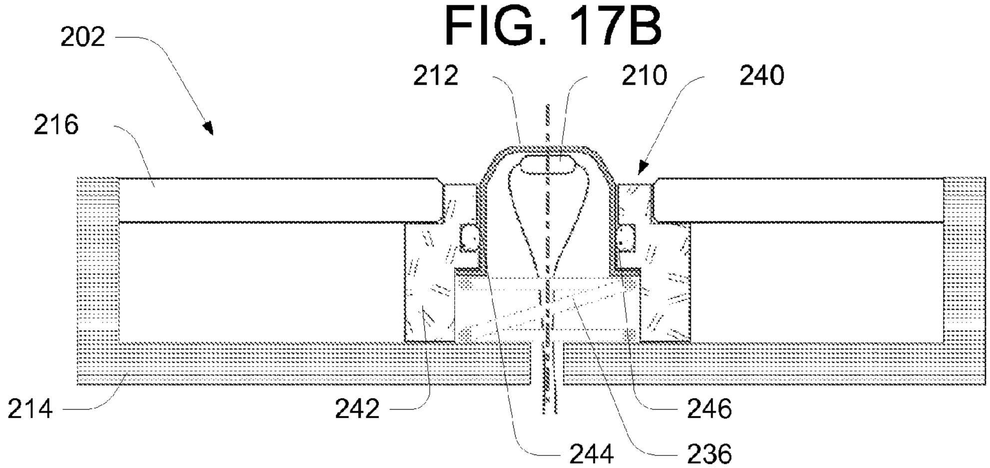


FIG. 17C

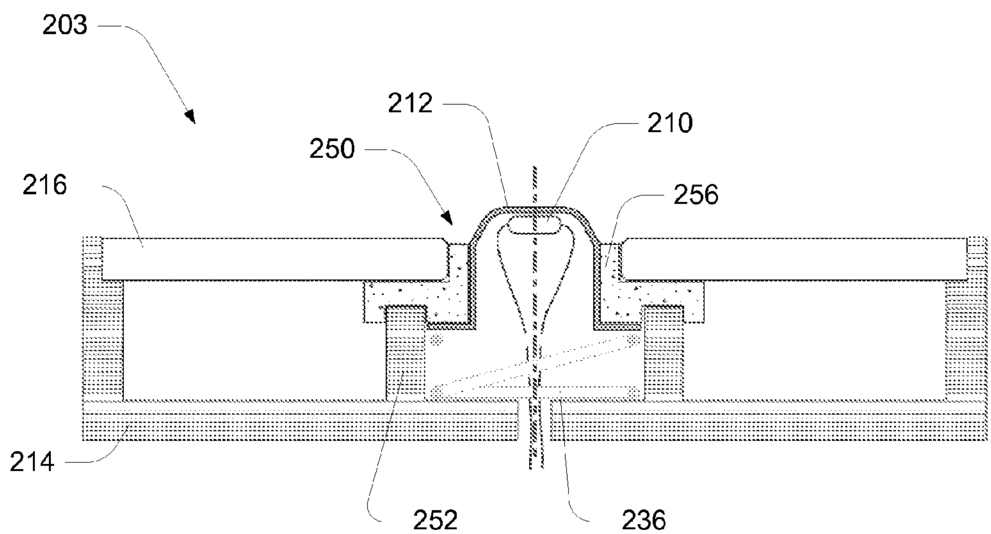


FIG. 17D

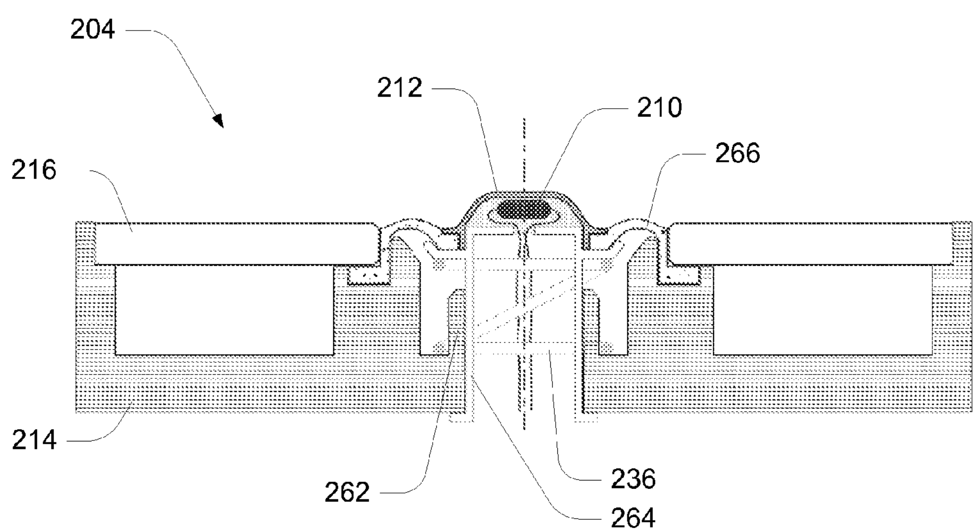


FIG. 17E

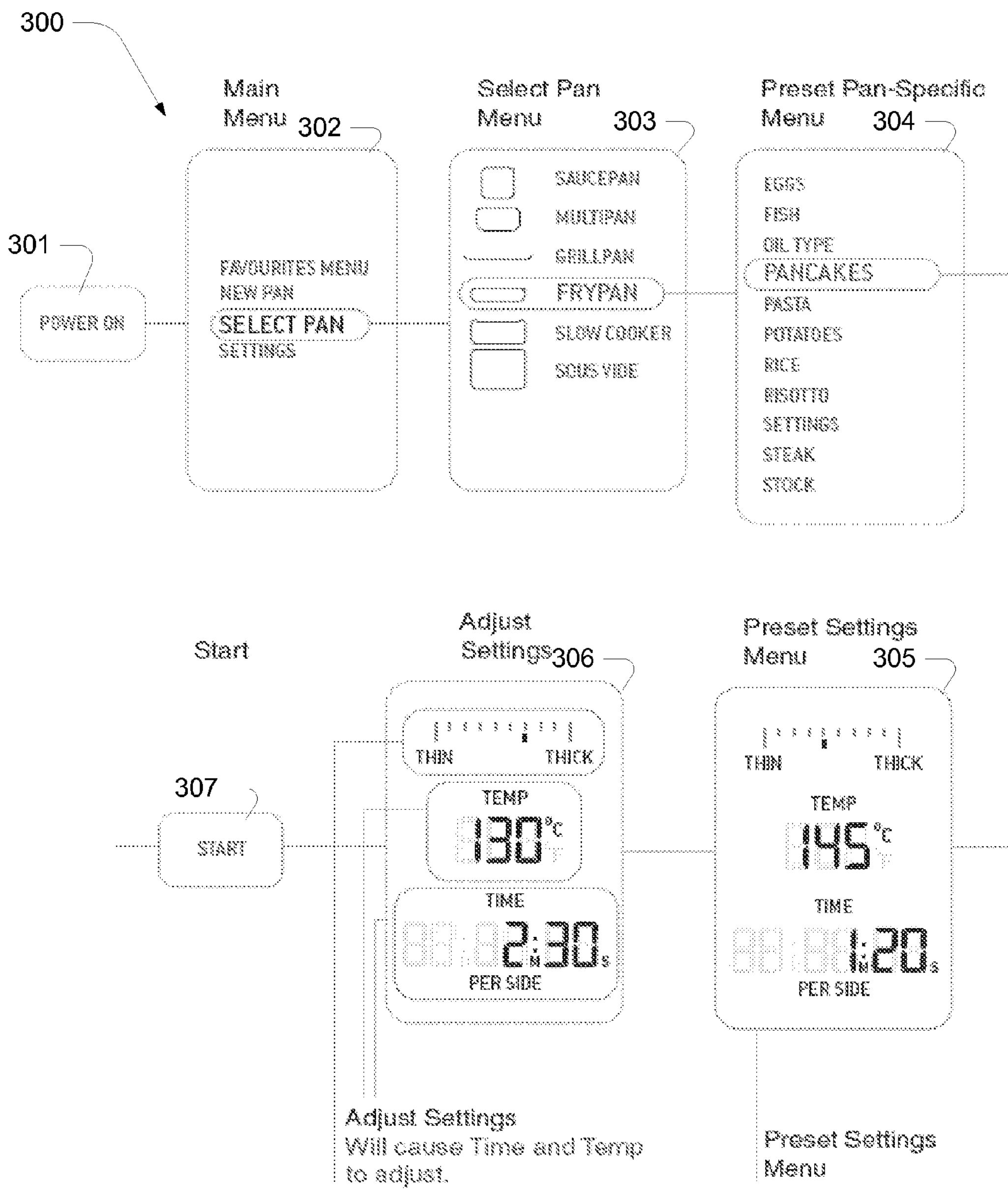

300
Main Menu
302
Select Pan Menu
303
Preset Pan-Specific Menu
304
301
POWER ON
FAVOURITES MENU
NEW PAN
SELECT PAN
SETTINGS
SAUCEPAN
MULTIPAN
GRILLPAN
FRYPAN
SLOW COOKER
SOUS VIDE
EGGS
FISH
OIL TYPE
PANCAKES
PASTA
POTATOES
RICE
RISOTTO
SETTINGS
STEAK
STOCK
Start
Adjust Settings
306
Preset Settings Menu
305
307
START
THIN
THICK
TEMP
130
°C
°F
TIME
2:30
PER SIDE
145
1:20
Adjust Settings Will cause Time and Temp to adjust.
Preset Settings Menu

FIG. 18A

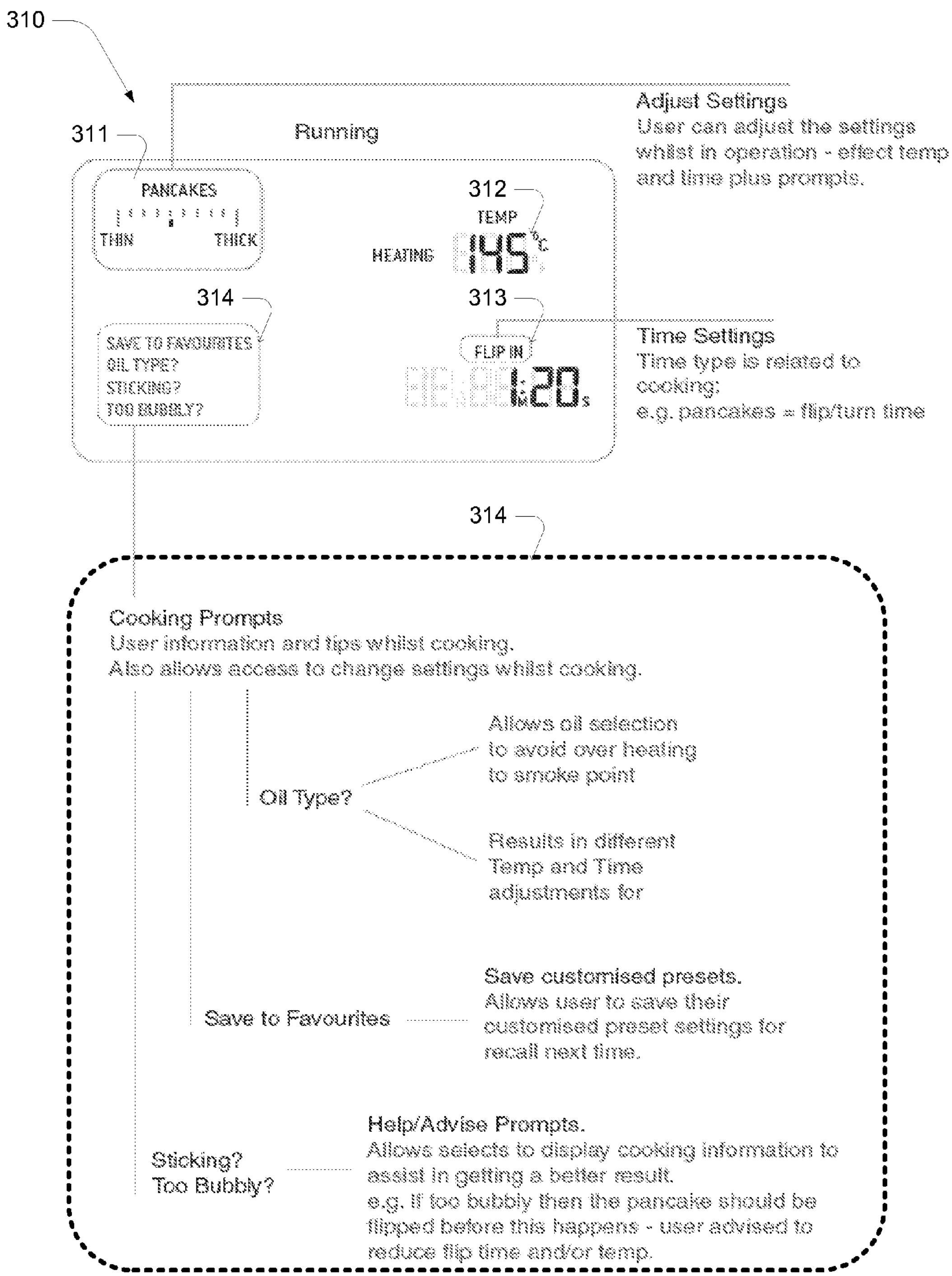

310
311
Running
Adjust Settings
User can adjust the settings whilst in operation - effect temp and time plus prompts.
PANCAKES
THIN
THICK
312
TEMP
HEATING
145
°C
314
313
SAVE TO FAVOURITES
OIL TYPE?
STICKING?
TOO BUBBLY?
FLIP IN
1:20
s
Time Settings
Time type is related to cooking;
e.g. pancakes = flip/turn time
314
Cooking Prompts
User information and tips whilst cooking.
Also allows access to change settings whilst cooking.
Oil Type?
Allows oil selection to avoid over heating to smoke point
Results in different Temp and Time adjustments for
Save to Favourites
Save customised presets.
Allows user to save their customised preset settings for recall next time.
Sticking?
Too Bubbly?
Help/Advise Prompts.
Allows selects to display cooking information to assist in getting a better result.
e.g. If too bubbly then the pancake should be flipped before this happens - user advised to reduce flip time and/or temp.

FIG. 18B

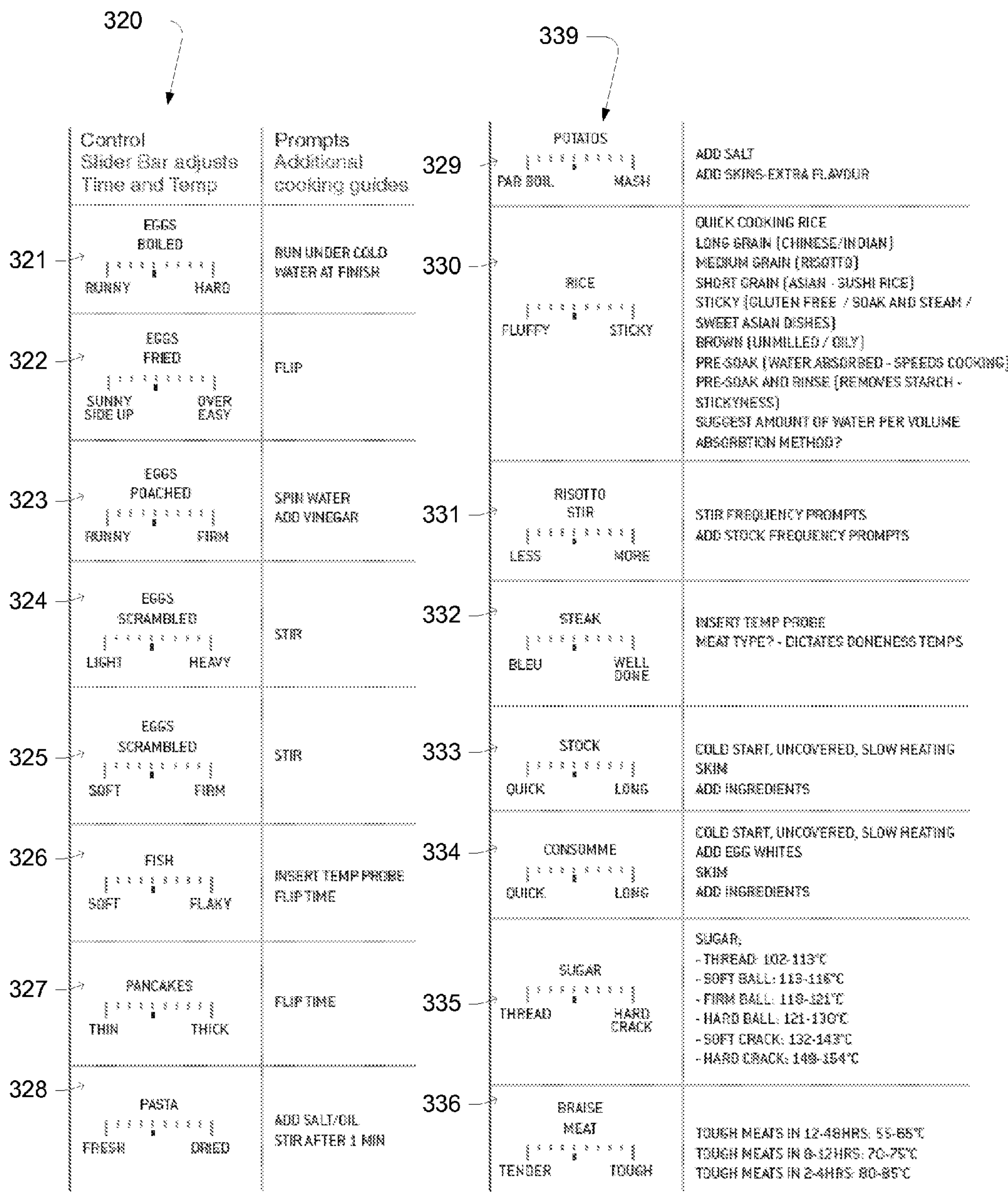

320
339
Control
Slider Bar adjusts
Time and Temp
Prompts
Additional
cooking guides
321
EGGS
BOILED
RUNNY
HARD
RUN UNDER COLD
WATER AT FINISH
322
EGGS
FRIED
SUNNY
SIDE UP
OVER
EASY
FLIP
323
EGGS
POACHED
RUNNY
FIRM
SPIN WATER
ADD VINEGAR
324
EGGS
SCRAMBLED
LIGHT
HEAVY
STIR
325
EGGS
SCRAMBLED
SOFT
FIRM
STIR
326
FISH
SOFT
FLAKY
INSERT TEMP PROBE
FLIP TIME
327
PANCAKES
THIN
THICK
FLIP TIME
328
PASTA
FRESH
DRIED
ADD SALT/OIL
STIR AFTER 1 MIN
329
POTATOS
PAR BOIL
MASH
ADD SALT
ADD SKINS-EXTRA FLAVOUR
330
RICE
FLUFFY
STICKY
QUICK COOKING RICE
LONG GRAIN (CHINESE/INDIAN)
MEDIUM GRAIN (RISOTTO)
SHORT GRAIN (ASIAN - SUSHI RICE)
STICKY (GLUTEN FREE / SOAK AND STEAM / SWEET ASIAN DISHES)
BROWN (UNMILLED / OILY)
PRE-SOAK (WATER ABSORBED - SPEEDS COOKING)
PRE-SOAK AND RINSE (REMOVES STARCH - STICKYNESS)
SUGGEST AMOUNT OF WATER PER VOLUME
ABSORBTION METHOD?
331
RISOTTO
STIR
LESS
MORE
STIR FREQUENCY PROMPTS
ADD STOCK FREQUENCY PROMPTS
332
STEAK
BLEU
WELL
DONE
INSERT TEMP PROBE
MEAT TYPE? - DICTATES DONENESS TEMPS
333
STOCK
QUICK
LONG
COLD START, UNCOVERED, SLOW HEATING
SKIM
ADD INGREDIENTS
334
CONSOMME
QUICK
LONG
COLD START, UNCOVERED, SLOW HEATING
ADD EGG WHITES
SKIM
ADD INGREDIENTS
335
SUGAR
THREAD
HARD
CRACK
SUGAR;
- THREAD: 102-113°C
- SOFT BALL: 113-116°C
- FIRM BALL: 118-121°C
- HARD BALL: 121-130°C
- SOFT CRACK: 132-143°C
- HARD CRACK: 149-154°C
336
BRAISE
MEAT
TENDER
TOUGH
TOUGH MEATS IN 12-48HRS: 55-65°C
TOUGH MEATS IN 8-12HRS: 70-75°C
TOUGH MEATS IN 2-4HRS: 80-85°C

FIG. 18C

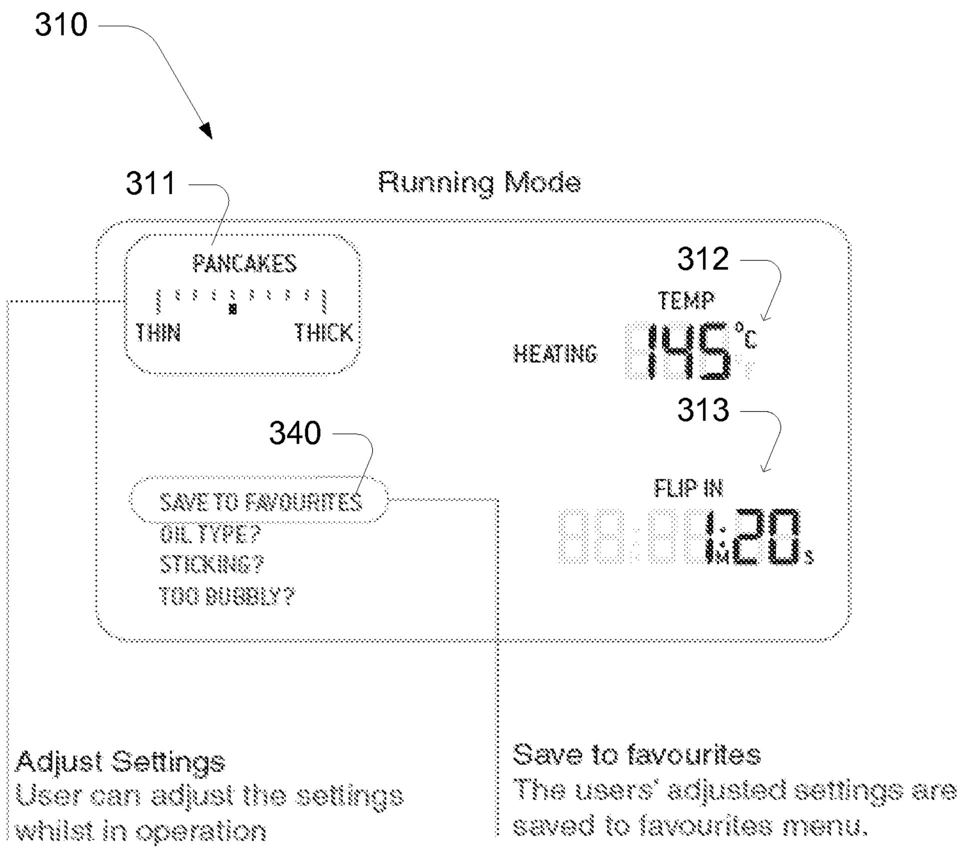

310
311
Running Mode
PANCAKES
THIN
THICK
312
TEMP
HEATING
145 °C
313
340
SAVE TO FAVOURITES
OIL TYPE?
STICKING?
TOO BUBBLY?
FLIP IN
1:20 s
Adjust Settings
User can adjust the settings whilst in operation
Save to favourites
The users' adjusted settings are saved to favourites menu.

FIG. 18D

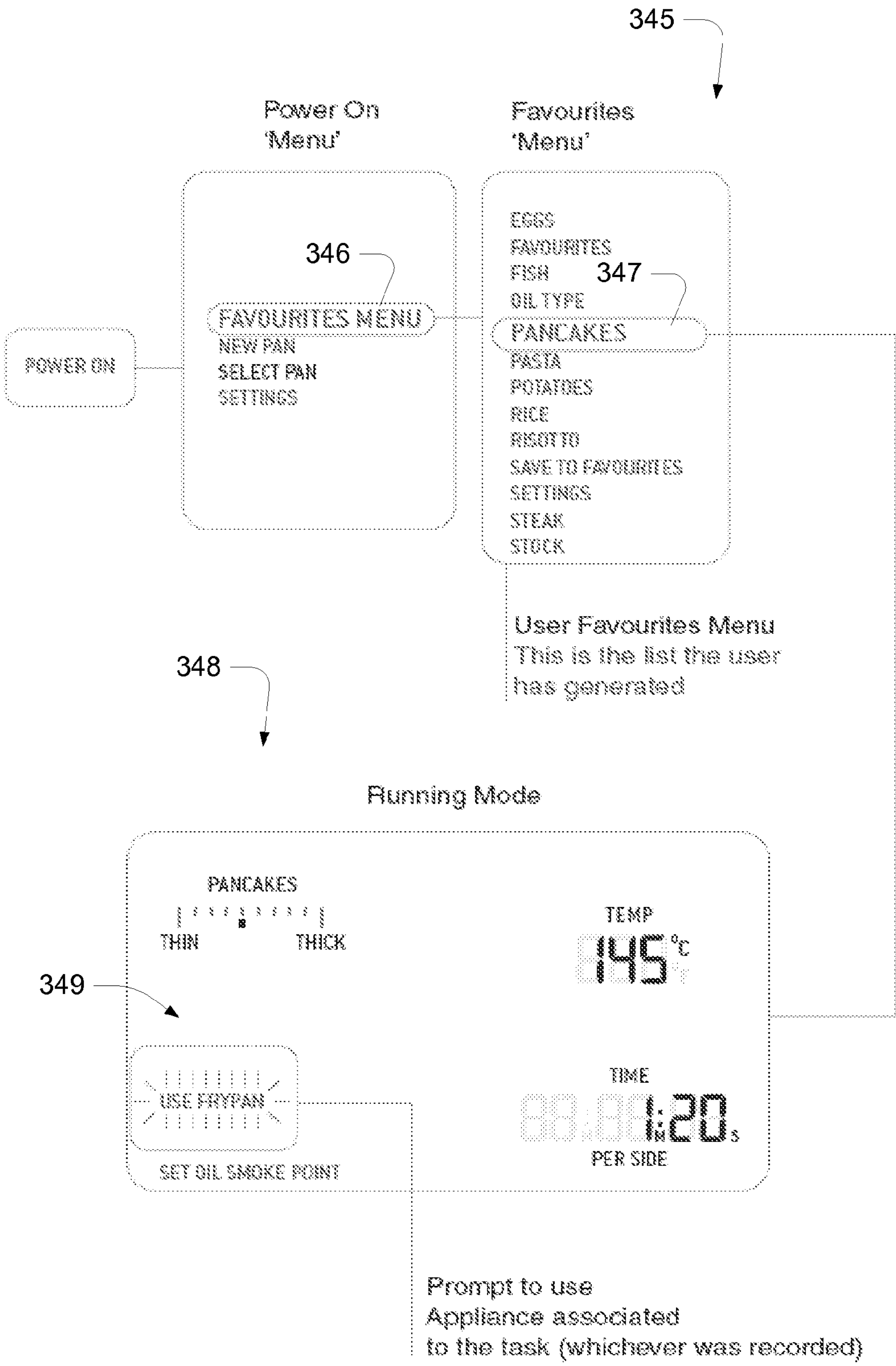

345
Power On
'Menu'
Favourites
'Menu'
346
FAVOURITES MENU
NEW PAN
SELECT PAN
SETTINGS
POWER ON
EGGS
FAVOURITES
FISH
347
OIL TYPE
PANCAKES
PASTA
POTATOES
RICE
RISOTTO
SAVE TO FAVOURITES
SETTINGS
STEAK
STOCK
User Favourites Menu
This is the list the user
has generated
348
Running Mode
PANCAKES
THIN
THICK
TEMP
145 °C
349
USE FRYPAN
SET OIL SMOKE POINT
TIME
1:20 S
PER SIDE
Prompt to use
Appliance associated
to the task (whichever was recorded)

FIG. 18E

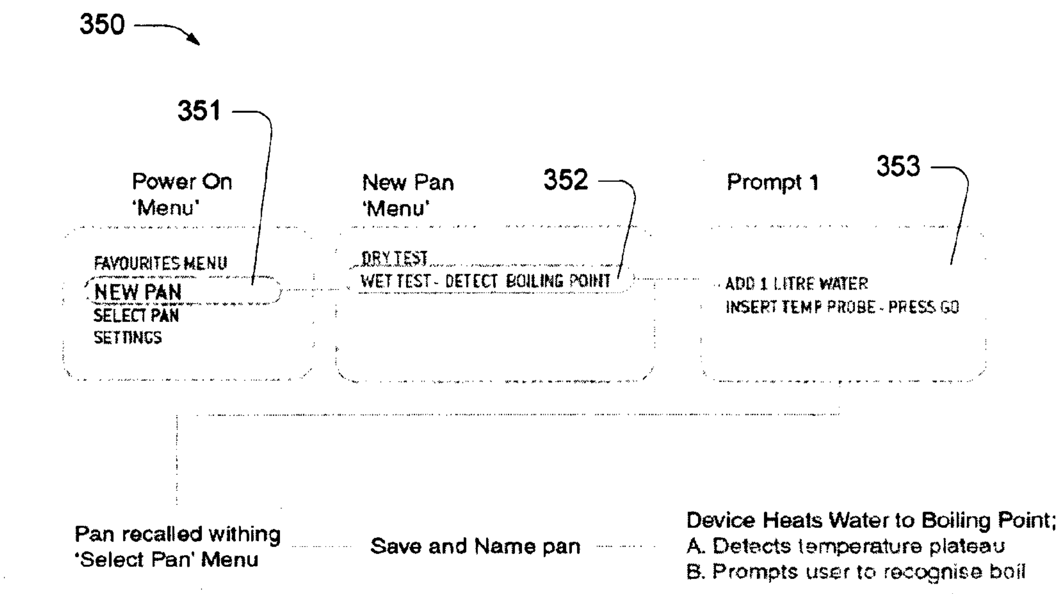


FIG. 18F

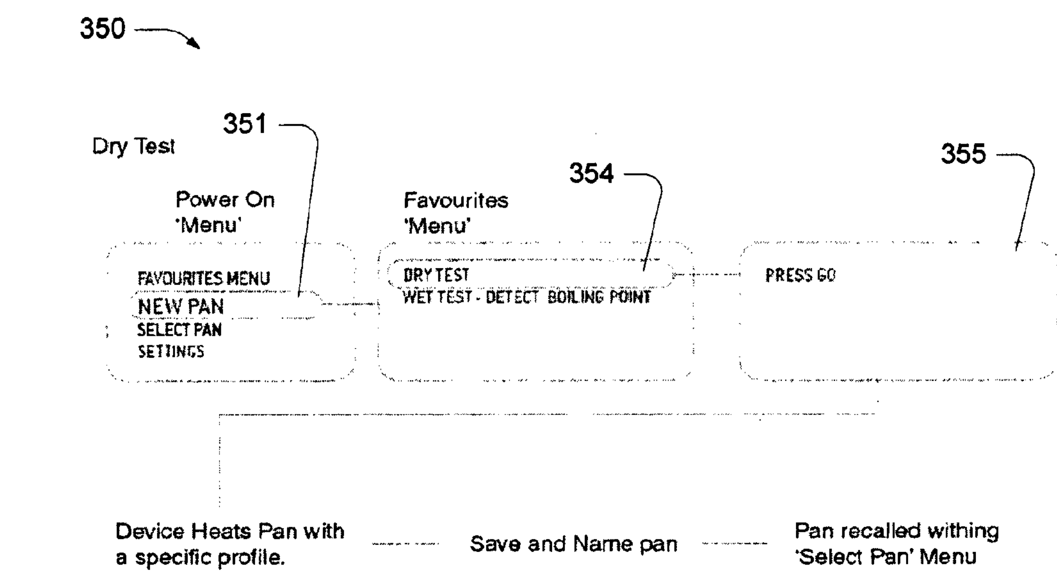


FIG. 18G

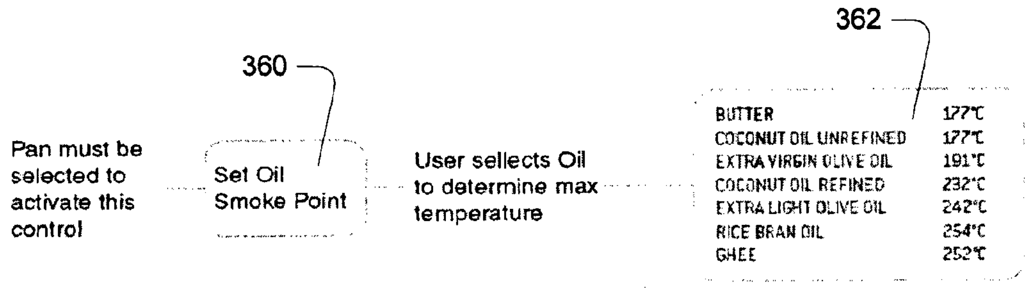


FIG. 18H

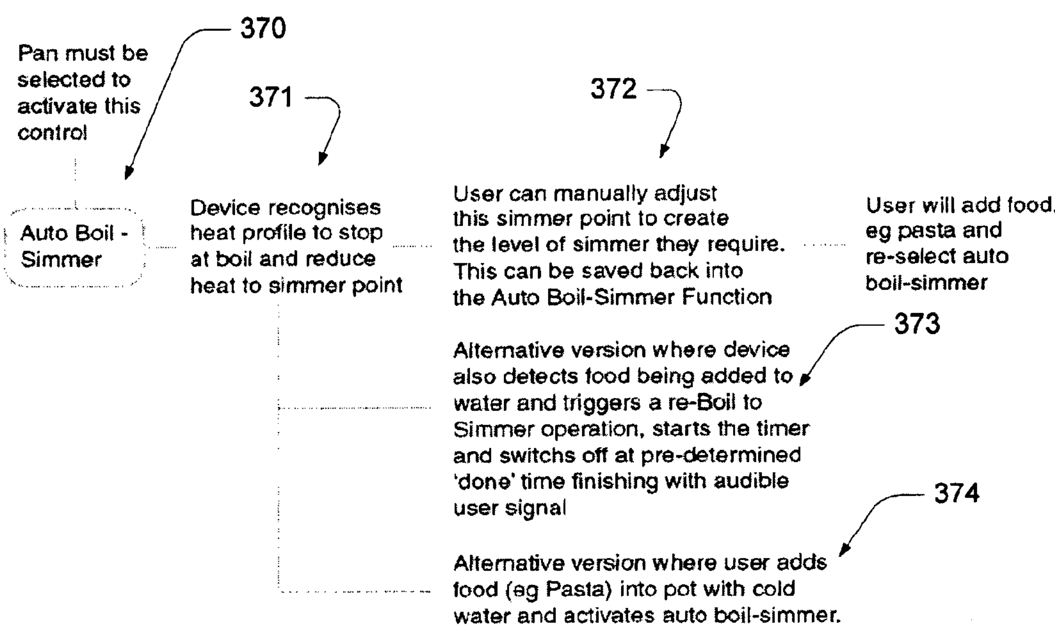


FIG. 18I

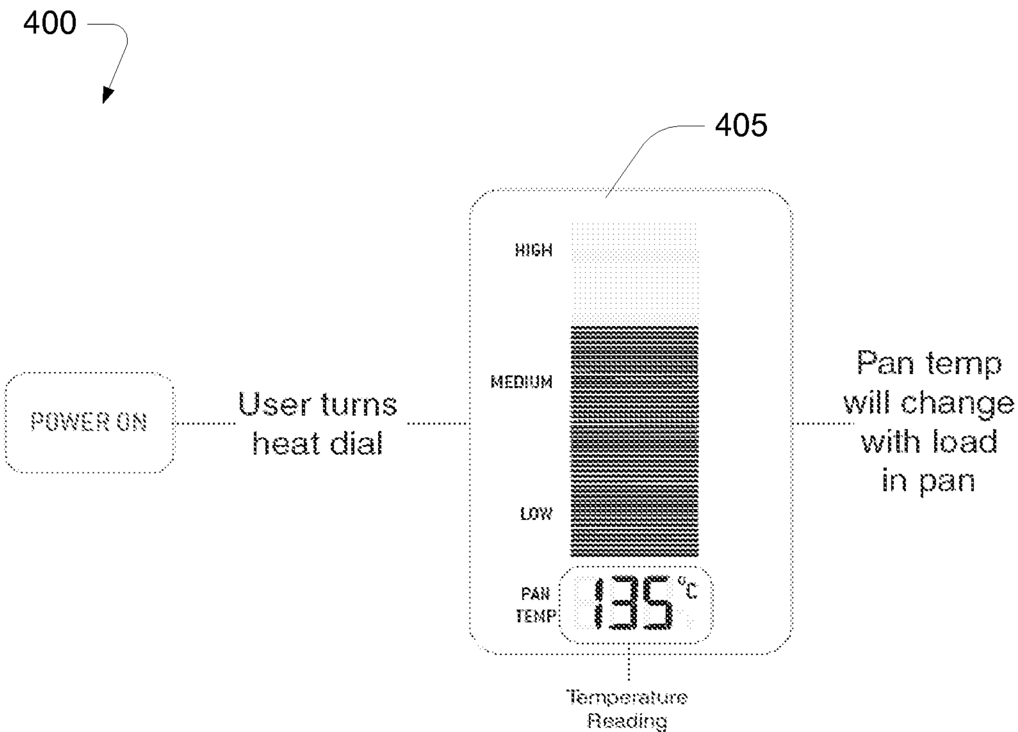

400
405
POWER ON
User turns heat dial
HIGH
MEDIUM
LOW
PAN TEMP
135 °C
Pan temp will change with load in pan
Temperature Reading

FIG. 19A

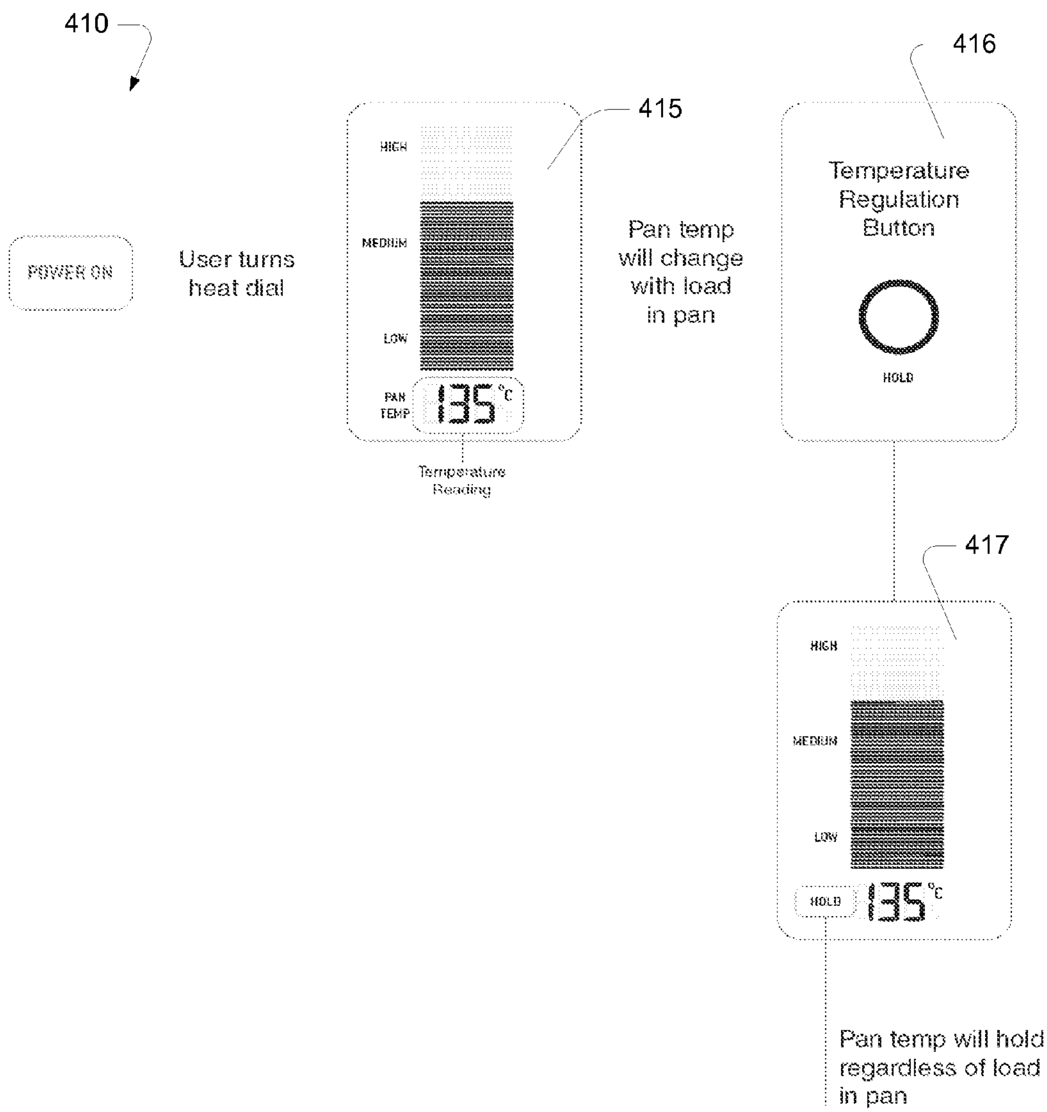

410
POWER ON
User turns heat dial
415
HIGH
MEDIUM
LOW
PAN TEMP
135 °C
Temperature Reading
Pan temp will change with load in pan
416
Temperature Regulation Button
HOLD
417
HIGH
MEDIUM
LOW
HOLD
135 °C
Pan temp will hold regardless of load in pan

FIG. 19B

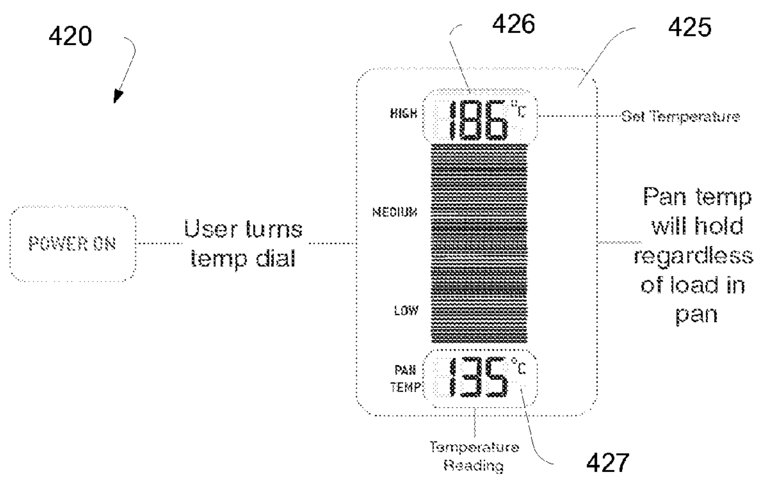


FIG. 19C

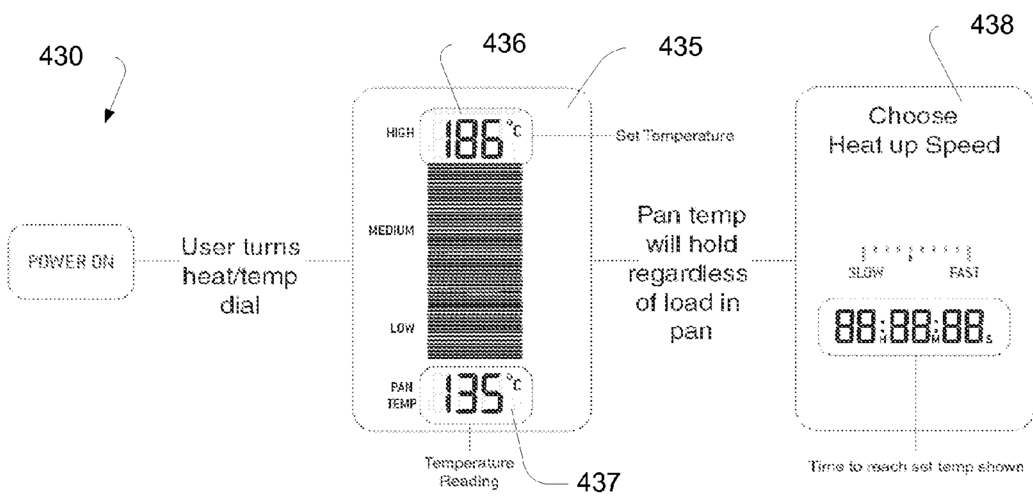


FIG. 19D

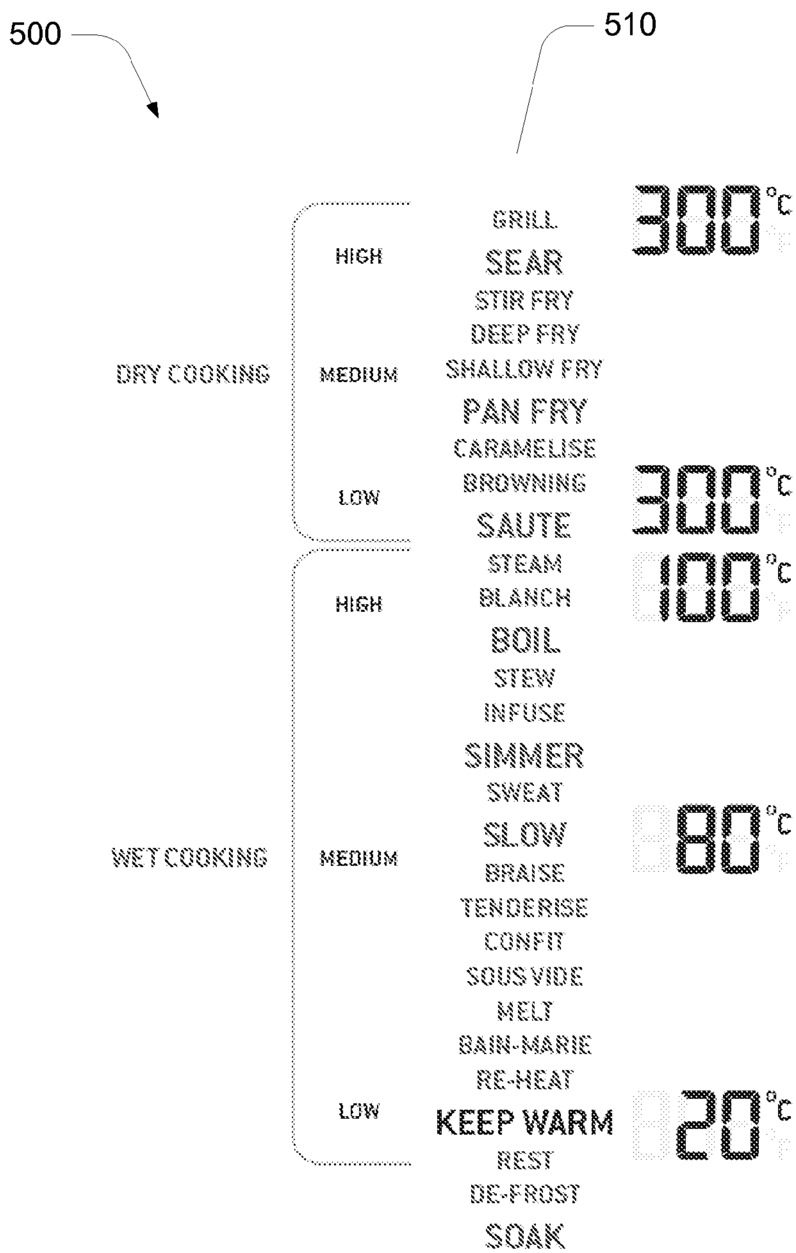

500
510
DRY COOKING
HIGH
MEDIUM
LOW
GRILL
SEAR
STIR FRY
DEEP FRY
SHALLOW FRY
PAN FRY
CARAMELISE
BROWNING
SAUTE
300 °C
300 °C
WET COOKING
HIGH
MEDIUM
LOW
STEAM
BLANCH
BOIL
STEW
INFUSE
SIMMER
SWEAT
SLOW
BRAISE
TENDERISE
CONFIT
SOUS VIDE
MELT
BAIN-MARIE
RE-HEAT
KEEP WARM
REST
DE-FROST
SOAK
100 °C
80 °C
20 °C

FIG. 20

600

Time Control

TIMER	COUNT UP / COUNT DOWN
FINISH TIME	SET END TIME (ELAPSE OR CALENDAR TIME)
DELAY START	SET START AND END TIMES (ELAPSE OR CALENDAR TIME)
STIR REMINDER	SET TIME TO ALERT 'STIR'
TURN REMINDER	SET TIME TO ALERT 'FLIP/TURN'
AT FINISH	KEEP WARM - TURN OFF - SET ANOTHER TEMPERATURE?
SET CLOCK	12/24 HR AND SET TIME ZONE
REST TIME	CAN BE LINKED TO FOOD COOKING MENU (RELATIVE TO MEAT TYPE/THICKNESS)

FIG. 21A

610

Cooking in any mode. User needs to leave cooktop unexpectedly

'Pause/Return' Button

Unit reduces power to preset keep warm temp or user defined level. Limited by food safety standards (no less 54°C in 4 hrs) if meat.

On return, 'Pause/Return' Button will return to previous state

FIG. 21B

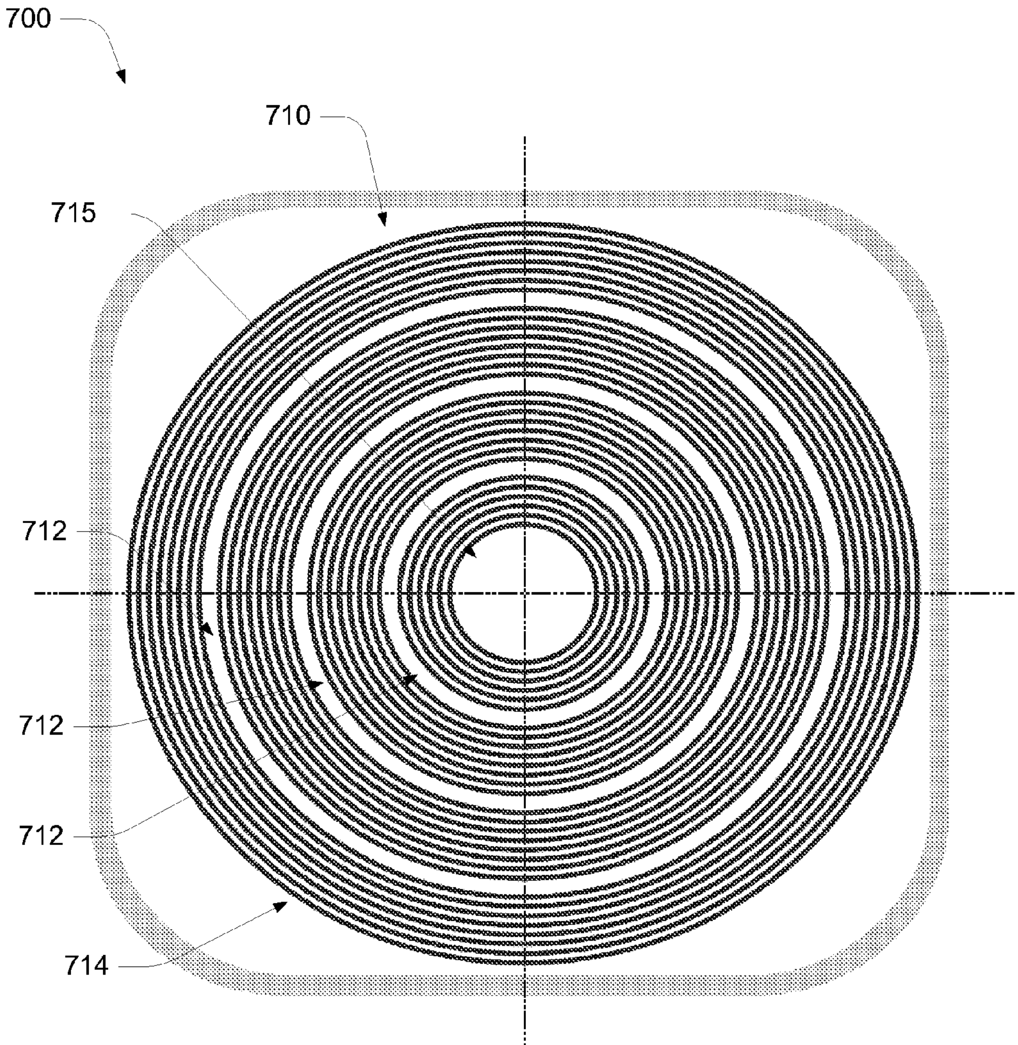


FIG. 22A

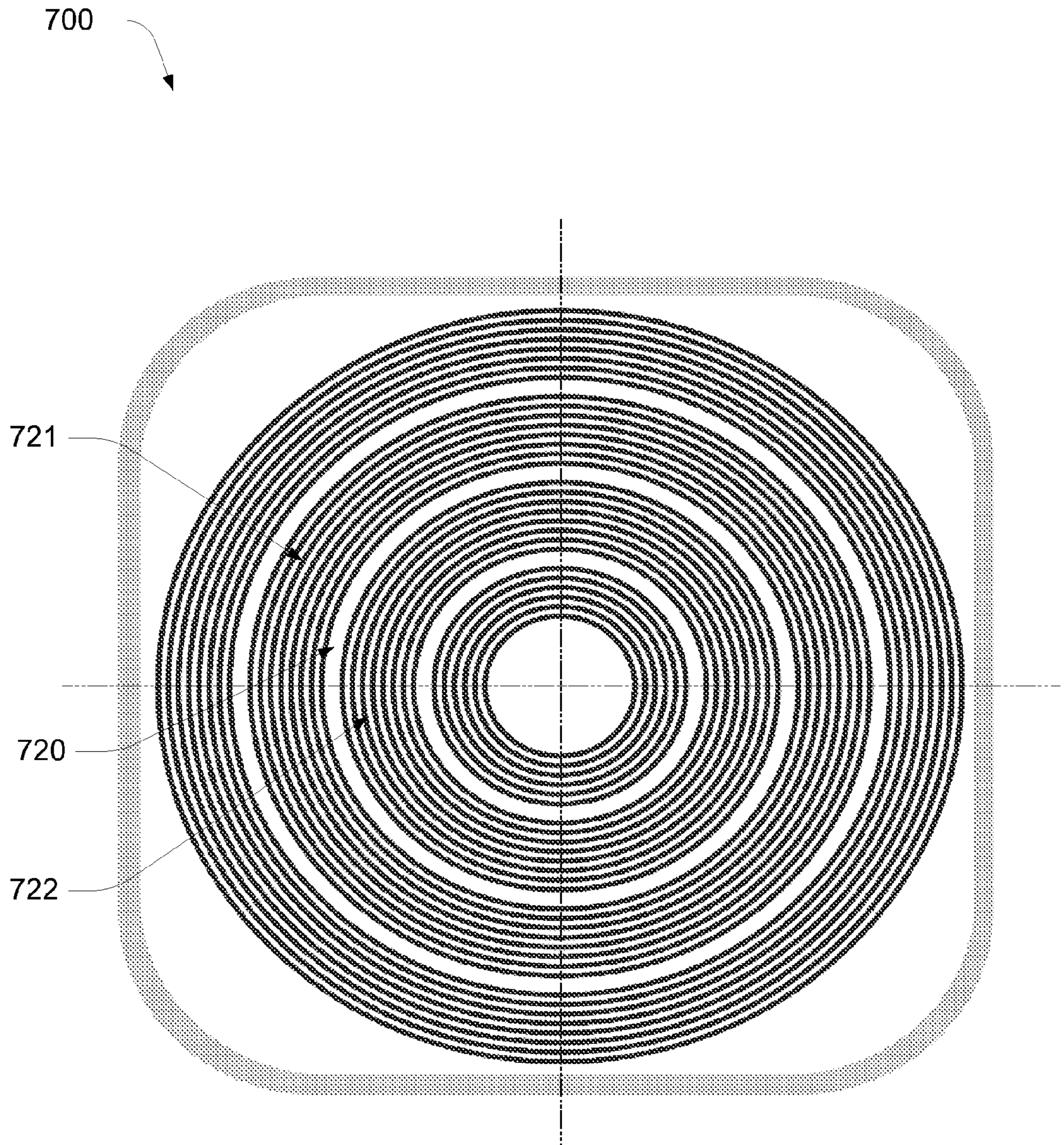


FIG. 22B

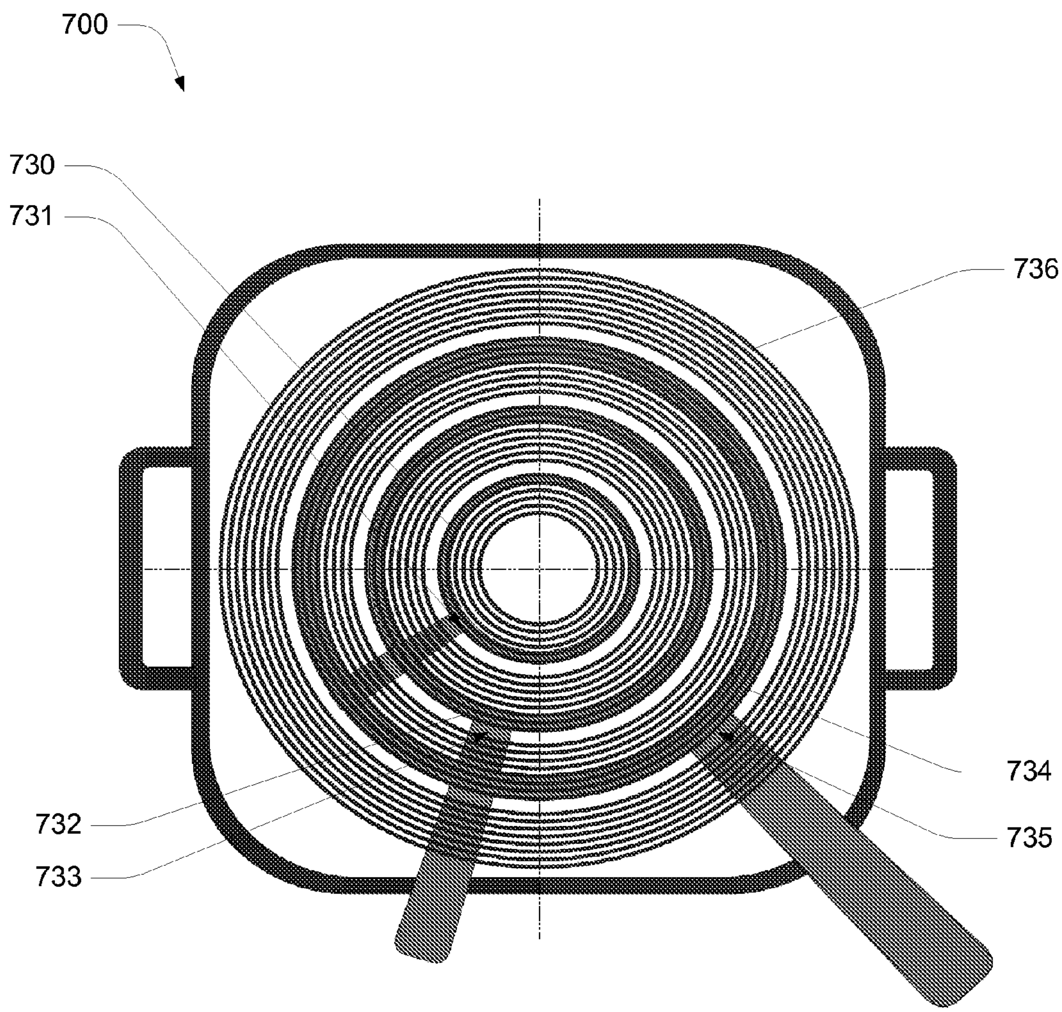


FIG. 22C

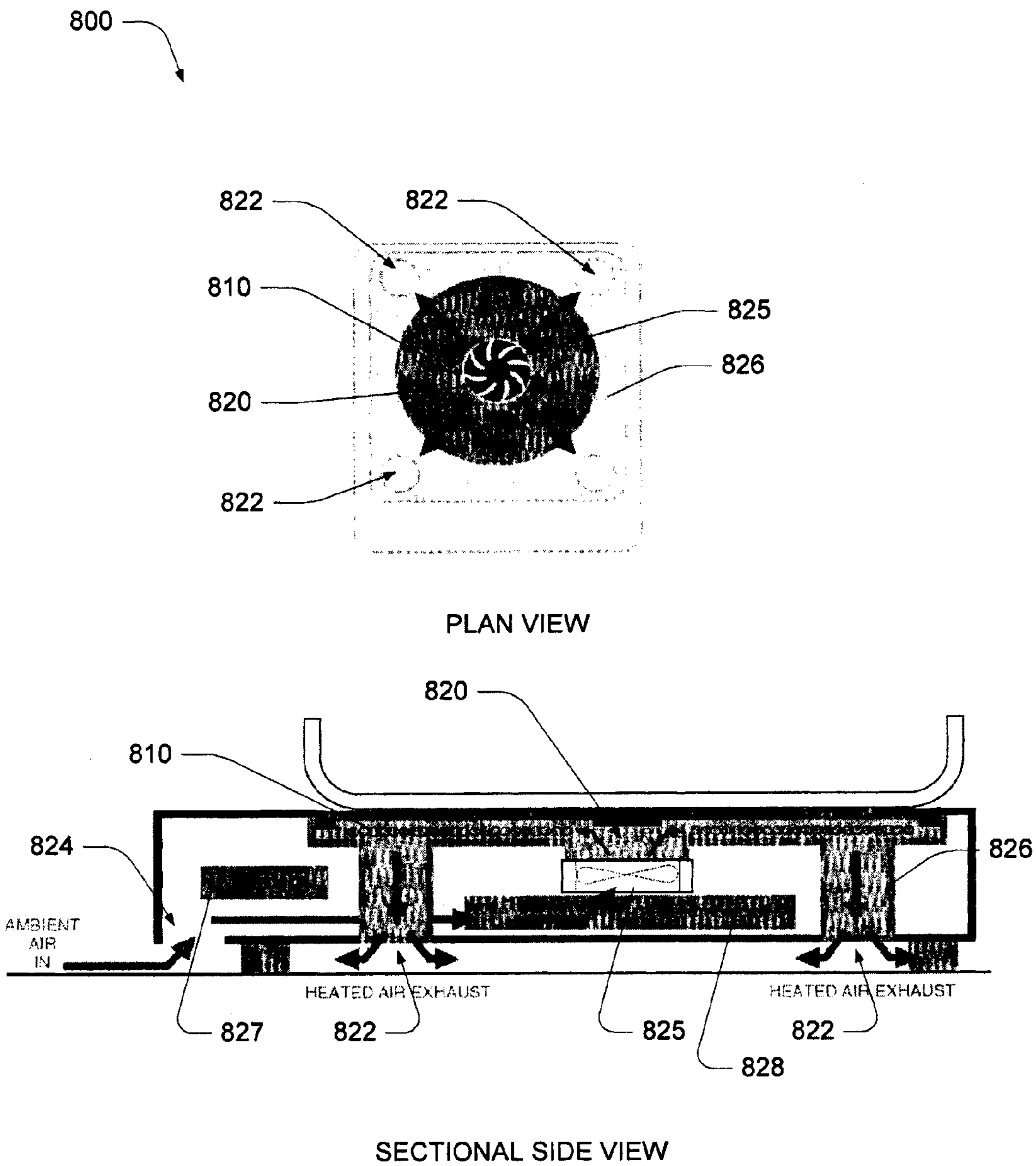
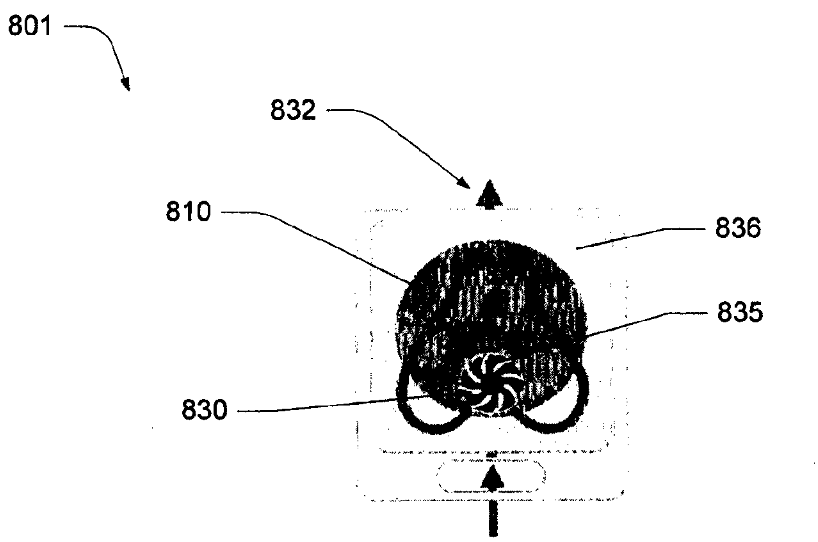
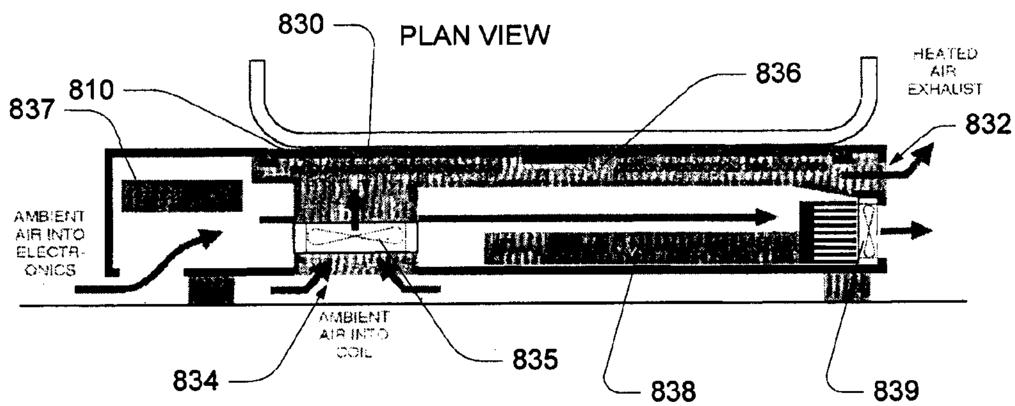

800
822
822
810
825
826
820
822
PLAN VIEW
820
810
824
826
AMBIENT AIR IN
HEATED AIR EXHAUST
HEATED AIR EXHAUST
827
822
825
822
828
SECTIONAL SIDE VIEW

FIG. 23A

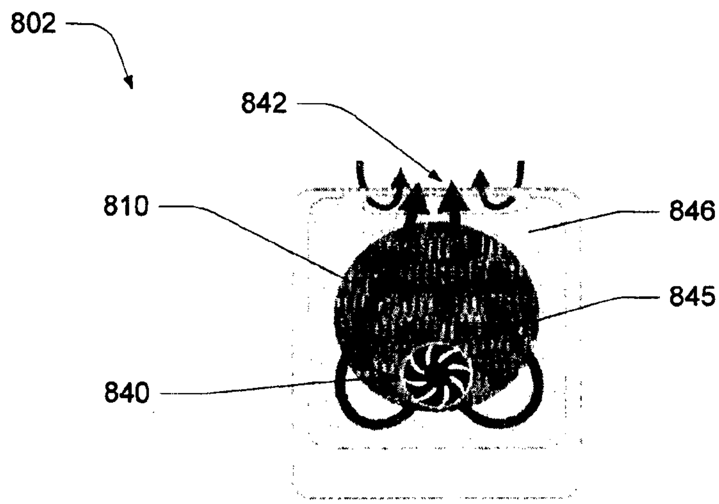


PLAN VIEW

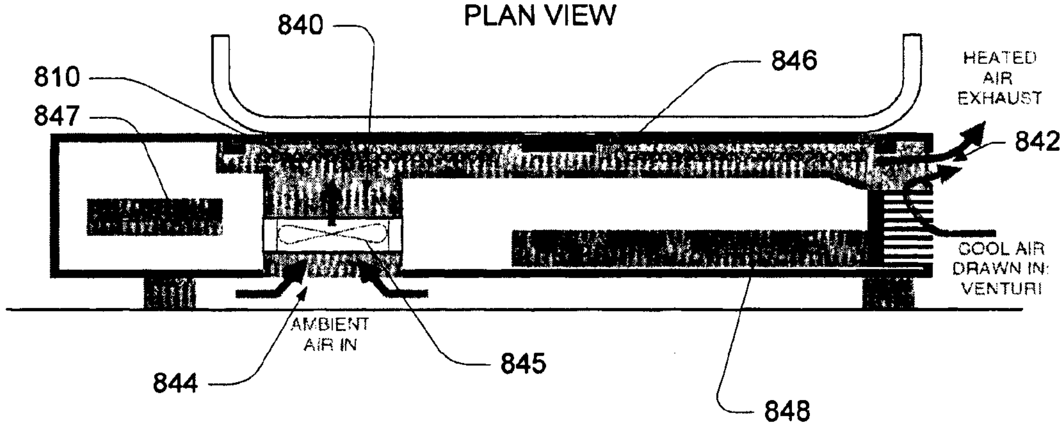


SECTIONAL SIDE VIEW

FIG. 23B



PLAN VIEW



SECTIONAL SIDE VIEW

FIG. 23C

MULTI COOKER

FIELD OF THE INVENTION

The invention pertains to induction cooking and more particularly to an induction heating appliance that is adapted to be used with a variety of different cookware vessels.

The invention has been developed primarily for use as a multi-cooker and will be described hereinafter with reference to this application. However, it will be appreciated that the invention is not limited to this particular field of use.

BACKGROUND OF THE INVENTION

Any discussion of the prior art throughout the specification should in no way be considered as an admission that such prior art is widely known or forms part of the common general knowledge in the field.

Existing stove top cooking does not provide enough feedback to the user regarding the temperature of the food being cooked. User control over conventional food warming appliances also requires manual intervention in a number of different steps during the cooking process. In conventional heating appliances, accurate temperatures are sometimes difficult to set and there is little or no user feedback as to how the cooking process is progressing. Accordingly, conventional cooking methods are associated with inadequate results and uncertainty as to the expected outcome of a heating operation.

OBJECTS OF THE INVENTION

It is an object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art, or to provide a useful alternative.

It is an object of the invention in a preferred form to provide an induction food cooking appliance with sophisticated features that assist with the automation, ease, predictability and quality of the cooking process when compared with manual alternatives.

SUMMARY OF THE INVENTION

According to an aspect of the invention there is provided a cooking appliance, the appliance comprising:

- at least one temperature controlled heating element;
- a user interface for receiving a user input setting for cooking; and
- a processor module that maintains a cooking data for cooking in accordance with the user input, and can provides prompts to the user during cooking.

According to an aspect of the invention there is provided a cooking appliance, the appliance comprising:

- at least one temperature controlled heating element;
- a user interface for enabling a user to select a predefined subject or predefined cookware for cooking; and
- a processor module that maintains a cooking data (sequence or procedure) for cooking the selected subject, and provides prompts to the user during cooking.

Preferably, the cooking appliance includes a cookware sensor for automatically identifying cookware being used. More preferably, the processor module, upon identification of the cookware, can adjust the selected cooking sequence or procedure.

Preferably, the cooking appliance includes one or more a temperature sensors. More preferably, the cooking appliance includes one or more remote temperature sensors. Most preferably, the processor module receives data from the temperature sensors indicative of the cooking temperature and can adjust or control the temperature controlled heating element according to the selected cooking sequence or procedure.

According to an aspect of the invention there is provided a heating element as herein described. Preferably, the heating element is operatively associated with one or more temperature sensors. More preferably, the heating element is associated with a cooling assembly.

According to an aspect of the invention there is provided a processor apparatus for a cooking appliance, the apparatus comprising:

- a user interface for enabling a user to select a predefined subject or predefined cookware for cooking;
- a database of cooking data including a sequence or procedure for cooking the selected subject;
- wherein apparatus is adapted to display one or more prompts to the user during cooking.

According to an aspect of the invention there is provided a user access interface for a cooking appliance, the appliance comprising a processor apparatus being coupleable to a database having cooking data; the interface comprising:

- a control program adapted to receive user input for selecting a predefined subject or predefined cookware for cooking;
- the control program adapted to, in response to the user input, display one or more prompts to the user during cooking.

According to an aspect of the invention there is provided a method for controlling a cooking appliance as herein described.

According to a further aspect of the invention there is provided a computer readable medium for operation with a processor device, the computer readable medium comprising computer code for executing a method as herein described.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

In order that the invention be better understood, reference is now made to the following drawing figures, in which:

FIG. **1** is a partially cross section plan view of an induction cooker and a conventional pot utilised in accordance with the teachings of the present invention;

FIG. **2**A is a schematic diagram illustrating the construction of an embodiment induction multi cooker in accordance with the teachings of the present invention;

FIG. **2**B is a schematic diagram illustrating the construction of an embodiment induction multi cooker in accordance with the teachings of the present invention;

FIG. **3** is a plan view of a generally square induction heating coil;

FIG. **4** is a schematic plan view of a rectangular induction heating element;

FIG. **5** is a schematic plan view of an oval induction heating element;

FIG. **6**A is a schematic cross section of an induction appliance and cooking vessel;

FIG. **6**B is a schematic cross section of an induction appliance, shown used with a cooking vessel;

FIG. **7** is a schematic cross section through the device depicted in FIG. **6**A;

FIG. **8**A is a schematic cross section through another embodiment of induction cooker and pot;

FIG. **8**B is a cross section through the device depicted in FIG. **8**A;

FIG. **8**C is a cross section through a second embodiment of a combination of induction cooker and cooking vessel;

FIG. 9A-FIG. 9H illustrate different embodiments of temperature sensing elements working in association with a cooking surface on an induction multi cooker;

FIG. 10A is a schematic cross section through a cooking vessel incorporating an RFID tag;

FIG. 10B-FIG. 10D illustrate different embodiments of devices for measuring food temperature in conjunction with an induction multi cooker;

FIG. 11 is a schematic representation of a user interface panel for an induction multi cooker;

FIG. 12 is a second embodiment of a user interface panel;

FIG. 13 is a flow chart and graphs illustrating the implementation of a cooking programme;

FIG. 14 is a flow chart illustrating the implementation of a second cooking programme;

FIG. 15A is a schematic representation of an embodiment induction cooker and a cooking vessel, shown used with a silicone mat;

FIG. 15B is a schematic representation of an embodiment induction cooker and a conventional pot;

FIG. 15C is a schematic representation of an embodiment induction cooker and a cooking vessel, shown used with a silicone mat;

FIG. 16 is a schematic representation of an embodiment circuit that is responsive to temperature;

FIG. 17A-FIG. 17E show schematic views of example embodiment thermal sensors;

FIG. 18A-FIG. 18I show schematic views of embodiment control interface methods.

FIG. 19A-FIG. 19D show schematic views of embodiment control interface methods for input control;

FIG. 20 shows a list of cooking tasks structured in respect of a range of temperature;

FIG. 21A-FIG. 21B shows embodiment user interface settings associated with appliance timing control;

FIG. 22A-FIG. 22C show schematic views of embodiment induction coils assemblies; and

FIG. 23A-FIG. 23C show schematic views of embodiment induction coil cooling assemblies.

BEST MODE AND OTHER EMBODIMENTS

It will be appreciated that existing stove top cooking apparatus do not provide enough temperature feedback, user control and feedback. Specific cooking temperatures are typically difficult to set or maintain. There is little feedback for the user as to how the pot or cooking implement is reacting to the input of heat. This leads to user uncertainty, nervousness and can result in undercooked, overcooked or wasted food.

In an embodiment, a portable induction powered cooktop with one or more separate non electric cookware appliance vessels (for example Slow Cooker, Frypan, Grillpan, Kettle, Pot, Sous Vide or the like) can provides an operative relationship between the base and the cooking vessel. The induction base can recognize (automatically or by manual input from a user) the cookware appliance.

As shown in FIG. 1 a portable or counter top induction cook top appliance co-operates with non-electric cookware. In preferred embodiments the cooking appliance **10** has sensors and a micro processor which are able to recognise or identify automatically and without manual input from a user, the particular cookware **11** that occupies the upper, flat, cooking surface **12**. In this way, a single induction powered appliance **10** can co-operate with a slow cooker, frypan, grillpan, kettle, pot, sousvide apparatus or other cooking vessel of the type adapted to be used with an induction coil based cooking apparatus. As will be explained, some embodiments of the invention are adapted to utilise conventional cookware or as other embodiments are particularly adapted to co-operate with specially configured cookware. Some embodiments of the invention provide an appliance **10** that can co-operate with conventional and specially adapted cookware. It will be appreciated that in an alternative embodiments, the induction cook top appliance can be built-in, of integrated with a domestic cooking appliance.

As suggested by FIG. 1, FIG. 2A and FIG. 2B, and with reference to the utilisation of conventional cookware, an embodiment appliance **10** comprises a portable enclosure **13** having a user interface panel **14**. The user interface panel provides a number of user input switches and controls **15**, **16** and a display panel **17**; by way of example only, in the form of a liquid crystal display a TFT display, a Fixed Segment display, an LED display, an OLED display, or similar. It will be appreciated if the invention may be implemented with a touch screen for providing both display information and user inputs. The enclosure **13** provides a optional socket **18** for receiving the electrical lead **19** of a thermal sensor **20**. In the embodiment of FIG. 1, the sensor **20** is submersible in a food being cooked **21**, even when the vessels lid **22** is on the vessel **11**.

As shown in FIG. 2A and FIG. 2B, the appliance **10** comprises a cooking surface **12** below which is located an induction coil **23**. The coil has a central opening **24** within which is located a second sensor **25**. The first and second sensors **20**, **25** co-operate with a micro processor or micro controller unit (MCU) **26**. The micro controller **26** also receives inputs from the user operated switches and controls **15**, **16**. The MCU **26** co-operates with proportional control software **27** and a cooking control programme **28** to effect control over the power control hardware **29**. The power control hardware **29** supplies power to the induction coil **23** and supplies information **30** to the display panel **17**, that information providing feedback to the user regarding the users own selection of preferences using the user controls **15**, **16**, the progress of the cooking process and data as may be required regarding the cooking process. Other variations and embodiments will be disclosed below.

Proportional control software is used to give greater accuracy and control over cooking temperatures. Such proportional control regimes can be employed in particular temperature zones/ranges (for example 70-100 deg Celsius in 5 deg Celsius increments or 55-100 deg Celsius in 1 deg Celsius increments) to allow slow cooking, simmer and boil functions in ways that are considerably more accurate than conventional methods. It will be appreciated that other temperature ranges and increments can be specified or implemented. Proportional control software can restrict temperature overshoot which can result in overcooked food. It is not required that the temperature control software use proportional control throughout the entire cooking temperature range.

The MCU **26** can have or co-operate with solid state memory for the purpose of allowing the user to store favourite settings that can be easily returned to in subsequent cooking operations. Thus, particular setting can be remembered by pressing a user activated switch or button where upon the MCU will record the temperature data with respect to a particular piece of cookware so that a current operation can be repeated, with accuracy, after the current operation is actually completed. Thus, storing cooking information in this way provides the user with convenience and consistency.

The cooking control programme **28** can, for example, store or determine time and temperature profiles for the purpose of obtaining best cooking results. For example, in the example of a casserole, a user selected a 4 hour cooking time will obtain a different time and temperature profile than a user selected a 6 hour cooking time. In the instance of a 6 hour cooking time, the "heat up" time will be slower than the 4 hour time, resulting, in better softening of the connective tissue and muscle fibres in meat—thereby tenderising and forming gelatine.

The MCU **26** and its memory may also be used to obtain, record and store a heat profile of a particular item of cookware. This can be done, for example, by adding a fixed quantity such as one liter of water to a pan and measuring the temperature of the water or the vessel as power supply to the induction coil. The resulting temperature and time profile is indicative of the thermal mass (or a Heat Saturation Point) of the cookware. The resulting heat and time profile provides a "signature" of the cookware that can be interpreted and used by the MCU and subsequent cooking operations. A user can assign a name to this cookware signature for subsequent recall.

A particular piece of cookware suitable for induction heating, when new, may be supplied with an update device that can supply the MCU with programmes and parameters that apply to the cookware. The update device may be an RFID tag associated with the cookware or, for example, a USB memory stick device that contains programmes, data or other information that is particular to the vessel. This information can be downloaded to the MCU storage by plugging the USB memory into the appliance's USB interface or port. It will be appreciated that this information can be downloaded to the USB device from a data networks (e.g. the Internet) for uploading to the appliance.

It would be appreciated that an embodiment apparatus can provide connectivity to the Internet or home network for enabling updating of software. The software updates can include any one or more of the following: software improvements, new products, new recipes, or control to enable consumers to 'upgrade' their cookware.

One of the advantages of the present invention is that the presence of the MCU **26** allows data about the cooking process to be collected and utilised. Data can be collected from remote probes or from specially adapted vessels and their components. For example, the lid and handles of a vessel can be interchangeable, removable, and optionally equipped with temperature, pressure or other sensors. The lid of a vessel may be formed from cast iron and may incorporate a transparent window. The lid may have sufficient weight and a polymeric seal for promoting high pressure cooking when the lid is on. A lid may also be provided with openings or ports through which a probe may be inserted. Similarly, a vessels handles can be detachable and provided with sensors, stored information and means for wirelessly transmitting information to the MCU **26**.

As best shown in FIG. **2**B, the control MCU **26** can receive a plurality of data signals. The data signals can be indicative of temperature measured by: a respective one of a plurality of external temperature sensors **20** located within the cooking vessel **11**; and/or a respective one of a plurality of fixed mounted temperature sensors **25** located proximal to the cooking coils **23**.

It will be appreciated that the cooking apparatus can include communication methods **31** (or software) for enabling communication with a remote device **32**. This communication with a remote device can enable one of more of the following:

Updating software/firmware;

Diagnostics;

Customising a user interface

Communicating with an remote device;

Communicating with a wireless or wired systems—for example Bluetooth, WiFi, LAN, USB cable etc

Interfacing with any wireless device that can run an application and communicate.

In an embodiment, cookware can include "Cooltouch" Cast Handles. In an embodiment, cookware can enable interconnection with remote temperature probe, position, locking. A lid rest can be provided for enabling condensation to drip back into cookware.

In an embodiment, the appliances enclosure may be provided with a switched or unswitched power outlet **33** for the purpose of driving other devices. The outlet may be AC or DC, and used to power appliances such as a whisk, automatic pot stirrer, hand mixer or masher.

As shown in FIG. **3**, an induction coil **40** can be formed in the shape of a quadrilateral which is a square with rounded corners **41**. The coil **40** has a central opening **42** surrounded by a conductive, spiral, inductor **43**. In this embodiment, the inductor **43** has pairs of parallel sides **44**, **45**, and **46**, **47**. The bend radius of the similar corners **41** is optimised for the induction heating process. This induction coil is suitable for substantially square cookware having a base dimensions of about 310 mm wide by 310 mm long. It will be appreciated that other sized and shaped cookware can be used.

FIG. **4** illustrates a second embodiment of a generally quadrilateral induction coil **48**. In this example, the pairs of parallel sides **49**, **50** and **51**, **52** are of unequal lengths. Further, the central opening **53** has peripheral flat spots that are generally parallel with the side edges of the coil. This coil **48** is not constructed with offset curves. By way of example only, this rectangular shaped coil can have peripheral dimension of about 275 mm wide by 350 mm long, suitable for substantially rectangular cookware having a base dimensions of about 305 mm wide by 380 mm long. It will be appreciated that other sized and shaped cookware can be used.

Another embodiment of a non-circular induction heating coil **54** is depicted in FIG. **5**. In this embodiment, the longitudinal ends **55**, **56** have equal radii and there are a pair of parallel transfers peripheral sides **57**, **58**. The shape of the central opening **59** corresponds to the peripheral shape of the coil **54**. By way of example only, this lozenge shaped coil can have peripheral dimension of about 275 mm wide by 350 mm long, suitable for substantially lozenge shaped cookware having a base dimensions of about 305 mm wide by 380 mm long. It will be appreciated that other sized and shaped cookware can be used.

Yet another embodiment of a quadrilateral or non-circular induction heating element is depicted in FIG. **6**A and FIG. **7**. In this example embodiment, the overall external shape of the coil is square with rounded corners, but there is a gap **61** located between an inner portion **62** and an outer portion **63** of the coil. In this example, the presence of the gap **61** and the central opening **64** allows a plurality of temperature sensors (5 in this example) to protrude through the coil **6**o and through the upper surface **12**. In this example, each of the temperature sensors **65** present a rounded or domed upper surface **66** that protrudes above the upper surface **12**. In this example, the cooking vessel **67** has grooves or indentations **68** that accommodate the sensors **65**. The depth of the grooves or indentations **68** is less than the height of the sensor **65** above the upper surface **12**. Thus, when the vessel **67** is seated on the sensors **65**, there will be an air gap **69** between the bottom of the vessel and the upper surface **12**. The arrangement of rounded or domed top and co-operating groove or indentation in the vessel creates a positive mechanical engagement between the appliance **10** and the vessel **67**, optionally provides a way of accurately locating the vessel **67** with respect to the induction coil **60** and provides intimate thermal contact between the sensors **65** and the vessel **67**.

In an embodiment, the temperature sensing elements **65** are fixed in position, and protrude from the upper surface. The air gap defined, for example, is about 5 mm. It will be appreciated that the outer temperature sensing elements **68** can be used to locate the cookware.

It will be appreciated that, as shown in FIG. **6**B, having raised temperature sensing elements **65** and/or raised locating pins within a cook top can hold cookware **70** away from cook top surface (for example, 5 mm above the cook top). This enables the cook top to remain relatively cooler, further keeping internal components cooler (in particular, but not limited to, the coil element such as a Copper Litz Wire Coil) and making temperature sensing more efficient and/or accurate. It will be further appreciated that raised locating pins could also be used as additional temperature sensing points.

As shown in FIG. **8**A when the groove or indentation in the vessel **81** is a deep or deeper than the height of the sensor **82** above the upper surface **83**, then the vessel **84** will make planer contact with the surface **83**. As suggested by FIG. **8**B and FIG. **8**C, a cooking vessel, whether circular or not, maybe provided with a concentric circular groove **87** on its under surface **85**. When the radius of the groove **87** is equal to the effective radial distance of the sensor **81** to the centre of the coil **82**, the vessel **84** will be free to rotate **86** about the centre **82**.

As discussed with reference to FIG. **6** through FIG. **8**, this arrangement can facilitate the location of cookware with respect to the induction coil, assist in elevating the cookware during the cooking process to create an insulating air gap between the cookware and the upper surface and thus assist in keeping the upper surface **12** to a minimum temperature. It will be appreciated that, by way of example only, raising of the cookware can be achieved by use of a non-conductive 'trivetts', 3 dimensional raised protrusions in the formed glass cooking surface or a silicon mat.

As shown in FIG. **9**A through FIG. **9**G illustrate alternative arrangements for mounting the central thermal sensor with respect to the upper surface **12** of the appliance **10**.

As suggested by FIGS. **9**A (and **9**B) the central thermal sensor **90** is located below the upper surface **12** and within the central opening of the induction coil. Temperature indicated by the electrical output of the sensor **90**.

As shown in FIG. **9**C, the central or other temperature sensor or sensors **91** can protrude through an opening **92** in the upper surface **12**. In this example, a thermistor **93** is mounted onto a compression spring **94** so that the weight of a cooking vessel will cause the spring **94** to compress so that the sensor is flush with the upper surface **12** when a vessel is above it.

It will be appreciated that the purpose of a non-circular induction coil is to accommodate and optimise the utility of non-circular cookware. For given size appliance **10** it would be appreciated that the maximum cooking areas provided when the cooking vessel is either square or rectangular. Thus the promotion of even heating and cooking space efficiency is promoted when the size and shape of the induction coil is similar to the size and shape of the largest cooking vessel that will be used in conjunction with the appliance **10**.

As shown in FIG. **9**D, the sensor **95** can be flush at all times with the upper surface **12** owing to the opening **92** in the upper surface **12** into which the sensor is introduced.

As shown in FIG. **9**E, the sensor **96** may be fixed (not spring loaded **94**) and still protrude above the upper surface **12**.

As shown in FIG. **9**F, the sensor **97** may can be flush with the upper surface **12**, owing to the opening in the upper surface into which the sensor is introduced. The cooking apparatus includes a relatively thin layer of silicon **98** extending over the upper surface and sensor. It will be appreciated that this can provides a relatively smooth surface for cleaning.

As shown in FIG. **9**G, the sensor **97** may can protrude though the upper surface **12**, owing to the opening in the upper surface into which the sensor is introduced. The cooking apparatus includes a layer of silicon **99** extending over the upper surface and sensor. The sensor protrude though the upper surface **12**, and into the layer of silicon **99**. It will be appreciated that this can provides a relatively smooth surface for cleaning.

As shown in FIG. **9**H, the sensor **97** may can protrude though the upper surface **12**, owing to the opening in the upper surface into which the sensor is introduced. The cooking apparatus includes a layer of silicon **99** extending over the upper surface and sensor. The sensor protrude though the upper surface **12**, and though the layer of silicon **99**.

In an embodiment, a sensor mounted 'within' or 'though' the upper cooking surface, can protrude through a aperture therein, and a silicon or aluminum cover can be place atop the sensor to fit flush with the top surface and/or seal the aperture. By way of example only, the upper cooking service can be a glass cooking surface or a ceramic cooking surface.

As shown in FIG. **10**A, the co-operation and communication between a vessel **11** and the induction appliance **10** of the present invention can be enhanced by providing the vessel **11** with an RFID transducer **100**. The transducer **100** may be applied to the surface of, or embedded, within the vessel **11**. In this example, the transducer **100** is located within a cavity **101** located on a lower surface **102** of the vessel **11**. The RFID tag **100** is adapted to co-operate with a tag reader **103** located within the appliance **12** and co-operating with the MCU **26**. The RFID tag may have a memory for storing an identity or information about the vessel **11** into which it is embedded or associated with. Further, the vessel **11** may be provided with its own temperature sensor or sensors **104** as well as other sensors **105**. Information received from the one or more sensors **104**, **105** can be transmitted from the RFID tag **100** to the RFID transceiver **103**. In this way, information regarding temperature or other parameters associated with the cooking process can be provided from an individual vessel **11** to the appliance **10**. Further, information contained in the tags memory can then be utilised by the cooking control programme and proportional control software to optimise the operation of the appliance **10**, primarily by utilising this information to control the way that powers provided to the induction coil. Information from the RFID tag **100** or the sensors **104**, **105** can also be displayed to the user on the display panel **17**.

As shown in FIG. **10**B, information such as temperature information can also be collected by a submersible temperature probe **106**, connected by a wire **107** to a jack point **108** located on the appliance **10**. The appliance may also incorporate a USB port **109** adapted to receive a USB plug **110** associated with a temperature sensor **106**. As shown in FIG. **10**D, the temperature sensor **111** may be suspended from the rim of a vessel by a rigid or semi-rigid hook **112**. In this way, wireless communication **113** between the probe in and the MCU **26** can occur for example, as an exchange of any one or more of blue tooth, RFID or WI-FI signals.

The thermal or other cooking probes may be powered or charged by induction by placing the device on top of, close to or within the appliances enclosure. It can optionally use the primary induction power coil to charge the batteries in the probe.

A basic user interface panel **115** is shown in FIG. **11**. The panel incorporates rotating user inputs or temperature **116**, time **117** and heating intensity or heat task **118**. The display indicates the user selected temperature **119**, the actual temperature **120**, the current actual time **121** and the time remaining in the cooking process **122**. A central part of the display **123** provides visual feedback regarding the selections made by the user.

In an embodiment, by way of example only, one or more input control elements (**125**, **126**, and **127**) can be included to provide input data to control software and/or a cooking programme. Input data can be indicative of a set point to recalibrate a cooking process (for example, a user preferred simmer temperature).

A user can pre-set time and temperature settings that are to their personnel liking. Thus, the appliance can obtain and store one or more custom settings that can be recovered at later time for cooking operations that are performed repeatedly by a particular user. By way of example only, low temperature settings, as may be used for soaking or sprouting beans or legumes may be provided.

Because the appliance **10** is intended to be used with a variety of cookware, particular controls, such as user selectable temperature controls may be provided by a dial with variable step or variable index control of the dial. For example, the same dial may provide different user feedback in different cooking regimes. In first regime, the dial can provide three settings, low, medium, and high. The settings will be detectable by the user through touch feedback through the dial itself or by the indication provided on the display. However, in a different or second cooking mode, the same dial could provide ten index settings that are detectable by the user either by touch feedback or through visual display. In some embodiments the resistance applied to the user control can be modified so as to provide different resistance to a turning force exerted by the user on the control.

A further embodiment of a user interface panel **130** is shown in FIG. **12**. The panel incorporates a visual display **131** that is sub-divided into functional segments **132**, **133**, **134**. In preferred embodiments, the appropriate user input controls (for example **135**, **136**, **138**, **139**) are provided below the appropriate display segment. For example, display segment **133** displays graphically the kind of appliance selected by the user using the rotating user input **135**. Another rotating user input **136** allows the user to select between a variety of different cooking tasks such as soak, warm, heat, slow, simmer, boil, sauté, fry and sear. The users selection is displayed in the adjacent segment **132**. A temperature display segment **137** displays the user selected temperature and measured temperature of a vessel in accordance with the selection made by a user on the adjacent temperature control **138**. Similarly, the user selected cooking time and the actual finish time are displayed in a time segment **134** located adjacent to the user's time selector control **139**. Various functions of the device are indicated in a function display segment **140** in accordance with a selection made on the rotating user input **141** located below.

FIG. **13** illustrates a sequence where by various user inputs determine how a particular cooking profile is selected by the MCU. In this instance, the profile comprises the intensity of the heating process over a time interval. In this example, the process begins with the user placing a vessel **150** on the upper surface **12**. The user selects an appliance, for example, by using the user input **135** discussed with reference to FIG. **12**. The selection of an appliance by the user **151** results in an appropriate display **133**, and may further comprise corresponding features or display options associated with the selected appliance **152**. The user then sets a desired cooking time **153**. Then, the MCU, in accordance with an algorism, utilises the user selections including appliance type and total cooking time to select a cooking profile from a look-up table contained in the MCU's storage **154**.

As shown in FIG. **13**, when the user selects a 2 hour cooking time for a particular recipe, the temperature increase is steeper **150** than when the user selects an 8 hour cooking time, wherein the initial temperature rise **156** is less steep. The temperature profile selected by the MCU is then used by the proportional control software and cooking programme to effectuate the rise **158**, maintenance **159** and decrease in temperature **160**, over time.

The versatility of the appliance **10** is further demonstrated by FIG. **14**, wherein the user places a frypan on the upper surface **12** to begin a cooking process **160**. The user indicates to the appliances MCU that a frypan has been selected **161**. The appropriate display is generated by the MCU for driving the display panel **17**. The display shows the information and features that are appropriate for the selected appliance **162**. An appropriate display for the user selection of a frypan may include a display of popular oil types from a list **163**.

As suggested by FIG. **14**, the displayed oil types could be, for example, butter, coconut oil unrefined, coconut oil refined, extra virgin olive oil, extra light olive oil, rice bran oil and ghee. The user is then able to select the type of oil that will be used in the cooking process **164**. That selection will in turn be determinative of the way that the MCU communicates information to the power control hardware and thus to the way that power supply to the induction coil. This temperature and time regime is monitored to create a feedback loop **165** that is continuously regulated during the cooking process.

It will be appreciated that, by selecting an "Oil feature" the user can select a fat/oil type to be used and the unit limits the heat to keep below a "smoke point" of the oil. As the fat or oil reaches a respective smoke point, it breaks down to glycerol and free fatty acids. The glycerol is then further broken down to acrolein which causes the smoke to be extremely irritating to the eyes and throat. The smoke point marks the beginning of both flavour and nutritional degradation, and therefore defines a preferred maximum usable temperature. This is useful for improving health and taste of the food cooked. For example, since deep frying is a very high temperature process, it requires a fat with a high smoke point.

Referring to FIG. **15**A through FIG. **15**C, in an embodiment a silicon based mat **170** (similar to the silicon layer **98**, **99** of FIG. **9**F and FIG. **9**G) could cover the entire upper cooking surface **171**. In use, the silicon based mat can be sandwiched between the cooking surface **171** and the cookware **172** placed atop the surface. This silicon based mat can, by way of example only, enable any one or more of the following features:

- maintaining an insulation layer, such that cooking surface can remain relatively cool, thereby keeping electronics and driving coil relatively cool;
- providing an aperture **173** for allowing a 'through the cooking surface' raised thermistor **174** to still touch the cooking vessel (as best shown in FIG. **15**A);
- removing the mat to enable a conventional 3rd party cookware of any size to be used on the system in conventional manner, as best shown in FIG. **15**B;
- including a passive RFID remote temperature sensing device **175** encapsulated within the silicon mat **170**, preferably centrally mounted as to minimise any effect

affected by the induced 'field' **176**, as best shown in FIG. **15**C; the RFID remote temperature sensing device can include an RFID 'Tag' **177** and a thermistor **178**, which becomes active when an active magnetic field is applied by the cooking apparatus, as best shown in FIG. **16**.

Referring to FIG. **16**, a tuned circuit **180**, including a thermistor **178**, enables the circuit to respond to temperature, according to a predetermined frequency response **185**. A specific frequency response **186** defines a frequency **187** as a function of temperature **188**. This can be used by the RFID tag in measuring/calculating temperature.

FIG. **17**A through FIG. **17**E illustrate, by way of example only, alternative arrangements for thermal sensors. **1**. In these example embodiments, detailed construction design for a direct pot temperature sensor include:

Design with an elastomer component;

Design with machined carbon polymer 'piston' components;

Design utilizing ceramic components.

Referring to FIG. **17**A, the temperature/thermal sensor assembly **200** can include an elastomer component. In this example, a temperature sensor **210** is located beneath and proximal to a covering element **212** (by way of example only, a dome element or an anodised aluminum dome cover or copper dome cover or non-ferrous dome cover). A fixed part **214** contains an assembly comprising an upper surface element (typically glass) **216** which is supported by a fixed support bracket **218**. In this example, an elastomer component **220** couples the covering element to the fixing assembly. This elastomer component can be bonded/pressed to the glass to create a seal **222**, and/or over moulded at the covering element **224**.

FIG. **17**B shows a temperature sensor assembly **201** comprising a polymer coupling **230**, which in this example include a pair of polymer 'piston' components **232**, **234**. The outer piston component **232** operatively supports the upper surface **216**, while the inner piston component supports the covering element **212** and temperature sensor **210**. The inner piston component is adapted to move in response to the application of a cooking appliance, and is upwardly biased by a bias element (typically coil spring) **236**.

FIG. **17**C shows a temperature sensor assembly **202**comprising a piston coupling **240**. An inner piston component **244** may be integrally formed with the covering element **212**. The outer piston element **242** can further include a sealing o-ring element **246** (typically formed of elastomer). The outer piston portion can be formed of, by way of example only, a polymer. In this example the dome element is movably retractable upon engagement with a cooking apparatus.

FIG. **17**D shows an alternative embodiment **203**, in which an elastomer element **256** supports the upper surface **216** and sealingly engages the cover element **210**. The outer piston portion **252** guides the cover element to a retracted position upon engagement with a cooking appliance.

FIG. **17**E shows a movable temperature assembly **204**, including an elastomer membrane **266** sealably coupled to the upper surface **216** and cover element **212**. An outer piston support **262** guides the centre assembly **264** (and thereby the cover element **212** and temperature sensor **210**) to a retracted position upon engagement with a cooking appliance.

It will be appreciated that the cover element **212** is adapted to move in a downward position upon engagement with a cooking appliance. This element is biased into an upward engaging orientation, for example a biasing element or a resilient coupling element.

Example embodiments of an intelligent relationship within a cooking apparatus can be represented in logic process/control diagrams. This intelligent relationship can be enabled through recognizing cookware properties. Before release of cookware, respective properties will be defined in the software. A cooking unit can have facility to update the software/firmware to enable forward compatibility for newly released cookware.

Advantages of the intelligent relationship within a cooking apparatus can include any one or more of the following:

Additional User Interface functions;

UI logic control to guide a user in interfacing with functionality;

A plurality of methods for a user to interface with the apparatus;

A "Cooking" Menu for automation control;

A "Task" Menu using slider bar that can assist a user control result in cooking;

Direct switch on with temp regulation bypassing automation, but user alerted to automation possible;

Direct switch on and no temp regulation (same as typical existing cook tops);

A "Learning Mode", wherein the apparatus can learn properties of 3rd Party cookware (AllClad, LeCreuset etc)—for example, Boil 1 ltr of water and record temp slope;

Altitude setting of unit to determine boiling point of water;

A customisable indexing of encoder dials—for example, to suit task or personal preference.

Appliance control can include any one or more of the following steps:

storing thermal properties of a plurality of cookware;

selecting the 'cookware' in use;

enabling access to easy to use functions;

selecting Cooking Task Presets to assist cooking (these can be customised and saved for later recall); and

adding/downloading new features.

FIG. **18**A through FIG. **18**I, disclose an example apparatus control interface.

Referring to FIG. **18**A, in this example, upon power-on **301** the main menu enables selection of **302**: "favourite menu", "new pan", "select pan" and "settings". By selecting "select pan", a select pan menu **303** provides a list of available known/selectable cookware. Upon selection of a specific cookware in the menu, a preset cookware specific menu **304** can be displayed. With a menu selected, a preset settings menu **305** can be displayed, showing the default preset settings. These preset settings can be adjusted in the adjust settings menu **306**. Once settings are configured the user can select start **307**.

In the example shown in FIG. **18**A, a user has selected a frypan for cooking pancakes having a pre-set default setting of a medium thickness to be cooked for 1 minute, 20 seconds per side at a temperature of 140 deg Celsius, to which the user has adjusted the default settings to a thicker pancake cooked at a temperature of 130 deg Celsius requiring cooking time of 2 minutes 30 seconds per side.

Referring to FIG. **18**B, the appliance control mode **310** can allow a user to use preset functions. In an example of cooking pancakes, the user can adjust the settings **311** whilst in operation, for example effecting temperature **312** and cooking time **313**. The apparatus can further provide prompts **314** to the user in respect of a user adjusted cooking setting.

In this example, prompts **314** to the user can include any one or more of the following: "saved to favourites", "oil type?", "sticking?", and "to bubbly?". Upon user selection of particular cooking prompts the oil type can suggest oil selection for avoiding overheating and can result in different temperature and time adjustments. For sticking? and to bubbly? advice/help the apparatus can provide advice for providing a better result. Save to favourites enables a user to save their custom preset settings for later recall.

FIG. **18**C, shows the appliance control user interface including a slide bar adjustment in regards each of a plurality of cooking modes. For example, a slide bar adjustment **320** can change the recommended cooking temperature and/or cooking time and/or other presets. Associated prompts **329** can also be provided in relation to selected settings.

It will be appreciated that while FIG. **18**C shows control slide bar adjustments for: "boiled eggs" **321**, "fried eggs" **322**, "poached eggs" **323**, "scrambled eggs" **324**,**325**, "fish" **326**, "pancakes" **327**, "pasta" **328**, "potatoes" **329**, "rice" **330**, "risotto" **331**, "steak" **332**, "stock" **333**, "consume" **334**, "sugar" **335**, "braised meat" **335**—with associated prompts for additional cooking guides—the apparatus is not limited to these particular control interfaces.

Referring to FIG. **18**D, as previously disclosed, a user may select to save the current adjusted settings as a preset favourites. For example, the use may select (save to favourites) from the prompt menu **340**.

Referring to FIG. **18**E, upon saving adjusted settings to a favourites menu, the appliance can maintain a "favourites menu" **345** for selection by the user. For example, upon selected use of the favourites menu, user can select **346** one of the previously saved adjusted settings from the favourite menu. Upon selection of a particular favourites menu **347** (for example, pancakes), the user interface can display **348** the saved adjusted settings for the menu, and can provide prompts **349** in relation to the particular cookware selected in cookware or ingredients (such as oil) that were previously saved—thereby alerting the user to requirements in relation to this particular menu. It will be appreciated that this allows a user to move directly to a customized and saved menu.

The appliance control interface can further allow a user to configure new cookware for use with the user interface menu **350**. The cookware can be saved under a user defined name. Newly configured cookware can be recalled with the "select pan" menu.

FIG. **18**F shows that a new pan selection **351** can enable a user to has selected a wet test **352** by detecting a boiling point. The user is prompted to add one liter of water and insert a temperature probe and select 'go' **353**.

FIG. **18**G shows that shows that a new pan selection **351** can enable a user to has selected a dry test **354**. The user is prompted to select 'go' **355**. A dry test selection can include the apparatus heating a cookware with a specific profile.

The appliance control menu can also be used to access special automated functions. For example, FIG. **18**H shows user settings for set oil smoke point **360**, which can determine the maximum cooking temperature for a selected oil type **362**. For example, FIG. **18**I shows an autoboil-simmer function **370**, where the apparatus can recognise a heat profile to stop at the commencement of boiling and to reduce the heat to a simmer point **371**. The simmer point can be manually adjusted **372**. The apparatus may detect when food is being added to the fluid and commence a re-boil to simmer operation **373**. Similarly, the apparatus can detect the addition of food (for example, pasta) into cold fluid and automatically activate a boil/simmer function **364**.

The user interface can also enable heat/temperature control. Typically, a user can access any of these modes in the user interface, and temperature regulation can also be used. A user can determine the heat-up rate or time for gentle heating of delicate foods.

FIG. **19**A shows a heat input control mode interface **400**, wherein the apparatus functions as a typical cooktop. In this example, the user selects a temperature **405** (for example, turning a temperature setting dial) and only electrical power is applied to the heating coils. In this embodiment, temperature sensing can be used, but not necessarily fed back to user to protection against over heating of a cookware element (e.g. a pan) and/or sensor and/or internal components, by maintaining temperature below a preset upper temperature limit.

FIG. **19**B shows a heat input control mode interface **410**, wherein the apparatus functions as a typically cooktop when only power is applied. This mode allows a user to regulate temperature by selecting a temperature **415**. The cookware temperature can change with load, and a user can select a temperature regulation button **416** to hold a particular regardless of load in the pan **417**.

FIG. **19**C shows a temperature input control mode interface **420**, enabling full regulation of temperature **425**. The user interface displays the set temperature **426** and the current cookware temperature reading **427**.

FIG. **19**D shows a temperature and heat speed control mode interface **430**, which enables full regulation of temperature **235** with user control of the temperature rate. The user interface displays the set temperature **236** and cookware temperature **237**. The interface enables a user to select a time period for reaching the set temperature **238**. It will also be appreciated that this operation can also be automated when selecting a cooking process that involves a specified heat speed (for example, a Consume).

The user interface can further enable task control.

FIG. **20** shows a list of cooking tasks **500** structured in respect of a range of temperature, for guiding a user to select an appropriate temperature for a specific task **510**.

The user interface can further enable time control for cooking. The apparatus can include many selectable options for a user. Time control options can enable this user selection of any one or more of the following: timer (for example, count-up and/or count-down), finish time (for example, calendar time and/or elapse time), delay start (for example, set start time and end time), stir reminder, turn reminder, at finish, set clock and reset time.

FIG. **21**A shows, by way of example only, user interface settings **600** for time control.

FIG. **21**B shows a user initiated sequence **610** for using a pause/return function. Using a pause/return selection, the apparatus can reduce the cooking temperature to a "keep warm" mode. Food safety standards can be incorporated in to this mode by limiting the temperature and/or time that pause function can be enable.

Further aspects of the user interface can enable:

- a user can create a personal cooking profile by recording a cooking sequence for later recall—whereby the user can utilise a plurality of cooking functions within the user interface and save the process for later recall.
- enable custom settings for the apparatus, including: setting altitude, setting colours, sound selection and encoder calibration—whereby setting altitude, the boiling point of water can be established, colours can be selected for communicating cooking cycles or states, sounds (for example beep, tone or music) can be selected for particular operations or cooking states, prompts and alerts, and encoder calibrations can be set to alter the step selection and sensitivity of the apparatus control dials.

It will be further appreciated that the software and datasets available to the apparatus can be updated or maintained. This can include features for any one or more of the following: debugging, improving or adding cooking functions, adding cookware, and/or updating software/firmware.

The user interface can provide an External Temperature Probe Prompt. For example, when selecting a foods or cooking process that would benefit from using the remote probe—such as meat temp, achieving accurate+/1 deg C.). The apparatus can then use this additional temperature data to include into the heat input calculation. One or more probes can be connected at a time.

FIG. **22**A through FIG. **22**C show example embodiments of induction coils **700** using, by way of example only, Litz Wire Coil Construction. These coil constructions can increase efficiency of heating evenness; and/or increase efficiency of cooling.

FIG. **22**A shows, a multiple gap coil **710** within a single continuous coil type, i.e. a single driving coil). This coil construction includes a of gap regions **712** (or variations thereof) for assisting in reaching a larger outside diameter (OD) **714** for large cookware whilst retaining a small inside diameter (ID) **715** for smaller cookware. This coil construction further enable a substantially even 'power' distribute across the cooking the surface.

In this embodiment, by way of example only, a first plurality of substantially evenly distributed turns of the coil are separates from a second plurality of substantially evenly distributed turns of the coil by a substantially larger gap region. It will be appreciated that, while the coil comprises a single continuous coil type, plurality of coil turns can define a plurality of spaced band of substantially regularly spaced coil turns.

Referring to FIG. **22**B, the gap regions defined between adjacent bands of coil turns (for example gap region **720** defined between adjacent bands of coil turns **721**, **722**), can improve air flow through the coil—by providing an arrangement of one or more larger inter coil gap regions. By way of example, a coil with multiple gap regions can allow air flow from forced air system to flow through and around the coil.

Referring to FIG. **22**C, the gap regions defined between adjacent bands of coil turns can confirm with sizes of standard or supported cooking vessels. Coil with multiple gaps which match the predetermined size of different pieces of cookware to better optimise cooking/heating performance. By way of example only, the coil may include any one or more of the following:

- a first inner band edge **730** adapted to suit the size of small size cookware **731**;
- a second inner band edge **732** adapted to suit the size of medium size cookware **733**;
- a third inner band edge **734** adapted to suit the size of large cookware **735**;
- a fourth outer band edge **736** adapted to suit the size of large square cookware, such that the square cookware sits over largest 'ring' **736**.

An embodiment apparatus can include an induction coil cooling system. FIG. **23**A through FIG. **23**C show a coil constructed in a housing sealed to the underside of the cooking surface, with air forced into and guided out. This enables a coil to remain at lower temperatures and facilitates maintaining high heat in cookware (and protection for reliability in electronics). Using coil temperature feedback, a fan speed can be controlled (such as switch on or off, and/or speed controlled) to provide quieter operation at lower temperatures (e.g. during long slow cooking times). The fan can also operate to selectively cool a temperature sensor, for example when switching pots/or appliances.

Referring to FIG. **23**A, a cooling system **800** for a coil **810** can include:

- an relatively centrally located air ingress aperture **820**, for example located proximal (or under) a central temperature sensor; and
- an a plurality of air egress apertures **822**, preferably for creating relatively even coil cooling, for example located about the periphery of the coil.

In this embodiment, air **824** at a substantially ambient temperature is drawn (typically by a fan assembly **825**) into the cooling system and though the ingress aperture **820**, which then flows to the egress apertures **822**. Airflow is typically directed by a housing element **826**. It will be appreciated that, by drawing ambient temperature air over the electronic elements **827**, **828**, affective cooling of the electronic elements can also be maintained.

Referring to FIG. **23**B, a cooling system **801** for a coil **810** can include:

- an air ingress aperture **830** located proximal to a side of the coil; and
- one or more air egress apertures **832**, preferably for creating relatively even coil cooling, for example located about the periphery of the coil.

In this embodiment, air **834** at a substantially ambient temperature is drawn (typically by a fan assembly **835**) into the cooling system and though the ingress aperture **830**, which then flows to the egress apertures **832**. Airflow is typically directed by a housing element **836**. Using an air inlet at front of the apparatus, forcing air from front to a rear outlet can reduce mixing hot and cold air—pushing hot air away from the bench top and user.

It will be appreciated that, using a second fan **839** to draw ambient temperature air over the electronic elements **837**, **838**, affective cooling of the electronic elements can also be maintained.

Referring to FIG. **23**C, a cooling system **802** for a coil **810** can include:

- an air ingress aperture **840** located proximal to a side of the coil; and
- one or more air egress apertures **842**, preferably for creating relatively even coil cooling, for example located about the periphery of the coil.

In this embodiment, air **844** at a substantially ambient temperature is drawn (typically by a fan assembly **845**) into the cooling system and though the ingress aperture **84**o, which then flows to the egress apertures **842**. Airflow is typically directed by a housing element **846**.

It will be appreciated that, in this example embodiment, a venturi aperture **842** utilise the exhaust air from the egress aperture to draw ambient temperature air over the electronic elements **847**,**848**, to provide a second air flow path and enable effective cooling of the electronic elements can also be maintained.

While the present invention has been disclosed with reference to particular details of construction, these should be understood as having been provided by way of example and not as limitations to the scope or spirit of the invention.

Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment, but may. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner, as would be apparent to one of ordinary skill in the art from this disclosure, in one or more embodiments.

In the claims below and the description herein, any one of the terms comprising, comprised of or which comprises is an open term that means including at least the elements/features that follow, but not excluding others. Thus, the term comprising, when used in the claims, should not be interpreted as being limitative to the means or elements or steps listed thereafter. For example, the scope of the expression a device comprising A and B should not be limited to devices consisting only of elements A and B. Any one of the terms including or which includes or that includes as used herein is also an open term that also means including at least the elements/features that follow the term, but not excluding others. Thus, including is synonymous with and means comprising.

Similarly, it is to be noticed that the term coupled, when used in the claims, should not be interpreted as being limitative to direct connections only. The terms "coupled" and "connected", along with their derivatives, may be used. It should be understood that these terms are not intended as synonyms for each other. Thus, the scope of the expression a device A coupled to a device B should not be limited to devices or systems wherein an output of device A is directly connected to an input of device B. It means that there exists a path between an output of A and an input of B which may be a path including other devices or means. "Coupled" may mean that two or more elements are either in direct physical, or that two or more elements are not in direct contact with each other but yet still co-operate or interact with each other.

As used herein, unless otherwise specified the use of the ordinal adjectives "first", "second", "third", etc., to describe a common object, merely indicate that different instances of like objects are being referred to, and are not intended to imply that the objects so described must be in a given sequence, either temporally, spatially, in ranking, or in any other manner.

As used herein, unless otherwise specified the use of terms "horizontal", "vertical", "left", "right", "up" and "down", as well as adjectival and adverbial derivatives thereof (e.g., "horizontally", "rightwardly", "upwardly", etc.), simply refer to the orientation of the illustrated structure as the particular drawing figure faces the reader, or with reference to the orientation of the structure during nominal use, as appropriate. Similarly, the terms "inwardly" and "outwardly" generally refer to the orientation of a surface relative to its axis of elongation, or axis of rotation, as appropriate.

Similarly it should be appreciated that in the above description of exemplary embodiments of the invention, various features of the invention are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of one or more of the various inventive aspects. This method of disclosure, however, is not to be interpreted as reflecting an intention that the claimed invention requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the claims following the Detailed Description are hereby expressly incorporated into this Detailed Description, with each claim standing on its own as a separate embodiment of this invention.

Furthermore, while some embodiments described herein include some but not other features included in other embodiments, combinations of features of different embodiments are meant to be within the scope of the invention, and form different embodiments, as would be understood by those in the art. For example, in the following claims, any of the claimed embodiments can be used in any combination.

Furthermore, some of the embodiments are described herein as a method or combination of elements of a method that can be implemented by a processor of a computer system or by other means of carrying out the function. Thus, a processor with the necessary instructions for carrying out such a method or element of a method forms a means for carrying out the method or element of a method. Furthermore, an element described herein of an apparatus embodiment is an example of a means for carrying out the function performed by the element for the purpose of carrying out the invention.

In the description provided herein, numerous specific details are set forth. However, it is understood that embodiments of the invention may be practiced without these specific details. In other instances, well-known methods, structures and techniques have not been shown in detail in order not to obscure an understanding of this description.

Thus, while there has been described what are believed to be the preferred embodiments of the invention, those skilled in the art will recognize that other and further modifications may be made thereto without departing from the spirit of the invention, and it is intended to claim all such changes and modifications as fall within the scope of the invention. For example, any formulas given above are merely representative of procedures that may be used. Functionality may be added or deleted from the block diagrams and operations may be interchanged among functional blocks. Steps may be added or deleted to methods described within the scope of the present invention.

It will be appreciated that an embodiment of the invention can consist essentially of features disclosed herein. Alternatively, an embodiment of the invention can consist of features disclosed herein. The invention illustratively disclosed herein suitably may be practiced in the absence of any element which is not specifically disclosed herein.

The claims defining the invention are as follows:

1. A cooking appliance for heating an item used in food preparation or food serving or cooking, the appliance including:

a chassis having an upper platform for supporting the item in use;

an induction element located below the platform for heating the item in use;

a temperature sensing assembly having a temperature sensing element; the temperature sensing element providing a temperature signal indicative of a current temperature of the item;

a cooling assembly within the chassis for providing airflow about the induction element; wherein the cooling assembly includes a housing that defines a first cooling region about the induction element and a first fan for providing the airflow about the induction element; wherein the housing defines a substantially separate second cooling region about the processor module; and a second fan provides airflow about the processor module;

a user interface for enabling a user to select a desired temperature of the item in use; and

a processor module that receives the temperature signal and controls power to the induction element for providing the desired temperature;

wherein the temperature sensing assembly is exposed to a fan cooling path such that the temperature sensing element is selectively cooled from below.

2. The appliance according to claim **1**, wherein the processor module is adapted to adjust power supplied to the temperature controlled induction element according to a heating rate, wherein the heating rate is determined by the processor module or selected by the user.

3. The appliance according to claim **2**, wherein the user interface enables the user to indicate the heating rate by selecting a time period for reaching a user defined temperature.

4. The appliance according to claim **2**, wherein the user interface enables the user to select the heating rate by selecting one of a plurality of predefined heating rates.

5. The appliance according to claim **2**, wherein the user interface is further adapted to enable a user to select a cooking time;

the processor module, based on the selected cooking time, determines a heating rate associated with reaching the desired temperature;

the processor module receives the temperature signal and controls power to the induction element for providing the desired temperature and for controlling the heating rate; and

wherein the processor module selects a temperature profile in which a controlled heating rate for a shorter cooking time selected by the user is greater than a controlled heating rate for a longer cooking time selected by the user.

6. The appliance according to claim **1**, wherein the user interface enables time control by presenting user selectable options, the user selectable options including any one or more of the following: timer option, finish time option, delay start option, stir reminder option, turn reminder option, and heating period option.

7. The appliance according to claim **1**, wherein the temperature sensing assembly includes a cover element over the temperature sensing element; the cover element protrudes above an upper surface of the platform for making contact with the respective item in use; the cover element being movable with respect to the platform such that, upon presentation of the respective item in use, the cover retracts while maintaining contact with the respective item.

8. The appliance according to claim **7**, wherein the cover element is sealed to the platform by an elastomer membrane.

9. The appliance according to claim **8**, the temperature sensing assembly includes a piston guided by a support; a cap is located over the piston to seal the elastomer membrane there between.

10. The appliance according to claim **9**, wherein the cover element is movable within a guide; the cover element being biased into a protruding configuration above the upper surface.

11. The appliance according to claim **7**, wherein a sealing element is provided between the cover element and the platform.

12. The appliance according to claim **1**, wherein the temperature sensing assembly includes a remote temperature probe that provides a temperature signal indicative of a current temperature of the item in use.

13. The appliance according to claim **1**, wherein the first fan has a variable rate of rotation that is controlled by the processor module based on temperature sensed by the temperature sensing assembly.

14. The appliance according to claim **1**, wherein the housing causes air to flow above and below the induction element.

15. The appliance according to claim **1**, wherein the rate of rotation of each fan is separately controlled using feedback of a temperature signal indicative of a current temperature.

16. The appliance according to claim **1**, wherein the housing is proximal to an underside of the platform, such that air flows into and is guided out of the housing.

17. The appliance according to claim **1**, wherein power to the induction element is digitally controlled using real-time temperature feedback.

18. The appliance according to claim **1**, wherein the temperature sensing assembly protrudes above an upper surface of the platform for making contact with the respective item in use, and is movable with respect to the platform such that, upon presentation of the respective item in use, the temperature sensing assembly retracts while maintaining thermal contact between the temperature sensing element and the respective item.

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